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Greeley Environmental Impact Statement for Wastewater Facilities and the Wastewater Management Program

(U.S.) Environmental Protection Agency, Denver, CO Region VIII

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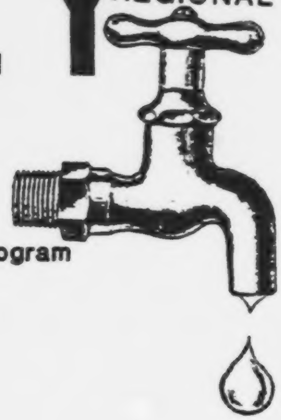

Environmental Impact Statement

For Wastewater Facilities And The Wastewater Management Program

U.S. Environmetal Protection Agency Region VIII, Denver

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This EIS is a supplement to the original EIS prepared in 1976 (PB-257 050), and analyzes additional alternatives for the City of Greeley.

16. ABSTRACT

This environmental impact statement discusses nine treatment processes for handling wastewater from the city of Greeley. Also addressed are ten areas of public concern relative to those alternatives: treatment efficiencies, effluent quality, surface water quality, ground water quality, public health, odor, visual, agriculture, land use and cost.

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GREELEY
ENVIRONMENTAL IMPACT STATEMENT

for

WASTEWATER FACILITIES
and the
WASTEWATER MANAGEMENT PROGRAM

Prepared by

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION VIII, DENVER

Approved by: ______________________
Roger L. Williams
Regional Administrator

DEC 27 1979

Executive Summary

This environmental impact statement (EIS) for the City of Greeley Wastewater Management Program was prepared for the U.S. Environmental Protection Agency (EPA) by URS Company of Denver, Colorado. The EIS is a supplement to the original EIS prepared in 1976 for this project. This supplement was necessary because a supplement to the original facility plan of 1975 has been prepared which analyzes additional alternatives for the City of Greeley.

The original facility plan recommended a new activated sludge wastewater treatment plant located east of Greeley at the "Delta" site. This proposed plan resulted in considerable local opposition. This fact, coupled with much higher revised cost estimates, caused the City to obtain grant money from EPA to study additional alternatives. In addition, EPA has recently been emphasizing alternative wastewater treatment systems.

Four alternatives identified nine treatment processes for treating Greeley's wastewater. They are:

- Delta Mechanical Plant
    - 12 mgd activated sludge plant
- Treatment and Discharge to Crow Creek
    - 24-day lagoon with reservoir storage and discharge
    - 24-day lagoon with direct discharge
    - 4-day lagoon with reservoir storage and discharge
- Treatment and Discharge to Crow Creek and Ogilvy Ditch
    - 24-day lagoon with reservoir storage and discharge
    - 24-day lagoon with direct discharge
    - 4-day lagoon with reservoir storage and discharge
- Land Application System
    - 24-day lagoon with reservoir storage for irrigation
    - 4-day lagoon with reservoir storage for irrigation

This EIS addresses ten areas of public concern relative to the new study: treatment efficiencies, effluent quality, surface water quality, ground water quality, public health, odor, visual, agriculture, land use and cost.

Findings related to these ten areas of concern are summarized in the following evaluation matrix.

IMPACT EVAL

ALTERNATIVE	TREATMENT EFFICIENCIES	EFFLUENT QUALITY	SURFACE WATER QUALITY	GROUND WATER QUALITY	
No Action.	Primary and secondary treatment at First Ave. plant: operation is complex due to 2 different treatment processes. Treatment is not consistent due in part to industrial loadings. Primary and secondary treatment at Evans plant: 2 aerated lagoons provide simpler operation. Third lagoon planned would improve efficiencies. Primary and secondary treatment of Hill's Park plant: 2 aerated lagoons provide simpler operation. Efficiency of treatment good.	First Avenue plant BOD - 26 MG/L average, suspended solids - 29 MG/L average. No data for Evans and Hill 'n Park.	First Avenue discharge to Poudre would continue with associated degradation of water quality assuming no improvements. Evans and Hill 'n Park would continue discharge beyond 1995. Minimal impact on water quality.	No effect.	No im recreati River f efficien health' slightly No im Hill' 'n
Delta Site Mechanical Plant 12 mgd, activated sludge	Primary and secondary treatment No nutrient removal achieved. Operation is less complex than First Avenue plant, but requires knowledge of various treatment processes to achieve effluent quality requirements.	BOD-10mg/l-23mg/l Suspended solids-25 mg/l Nitrogen-17.5 mg/l Salinity-657 micromho/cm Fecal coliform-30 day: 6,000/100ml	Removes discharge from Cache la Poudre R. New discharge to South Platte R. Improves water quality in Poudre, limited degradation to Platte.	No Effect	Improve of Pou Minimu to Platt treatmen
24-day detention, 12 mgd. lagoon, reservoir storage, discharge to Crow Creek.	Primary and secondary treatment. Potential for limited nutrient removal in res. Operation is simplified by a minimal amount of mechanical equipment. Additional treatment benefit from reservoir storage prior to discharge. Solids removal infrequent.	BOD-30 mg/l Suspended solids-30 mg/l, variable depending on season and efficiency of micro-strainers Nitrogen-15,5 mg/l Salinity-718 micromho/cm Fecal Coliform-307/100 ML to 5621/100 ML 30 day 6000/100 ML	Removes discharge from Cache la Poudre. New discharge to Crow Creek. Improves water quality in Poudre R. above Crow Creek. No benefit to Crow Creek Water quality, minimal improvement to S. Platte R. below Crow Creek.	No impact expected. Seepage expected from storage reservoir but collect channel at perimeter. Should collect water. No seepage from lined lagoons.	Improve of Pou above C to Crow below C
24 day detention, 12 mgd lagoon, discharge to Crow Creek.	Primary and secondary treatment. Minimal nutrient removal in lagoons. Operation is simplified by a minimal amount of mechanical equipment. Solids removal infrequent.	BOD-30 mg/l Suspended solids-30 mg/l, variable depending on efficiency of micro-strainers Nitrogen-15.5 mg/l Salinity-657 micromho/cm Fecal coliform - 307/100 ML to 5621/ML	Same as above	No impact expected. Lining of lagoons will prevent seepage.	S
4-day detention, 12 mgd. lagoon, reservoir storage, discharge to Crow Creek.	Primary and secondary treatment, storage reservoir is intergal part of treatment due to short detention time in lagoon. Operation is simplified by a minimal amount of mechanical equipment, however, maintenance is increased due to more frequent solid removal. Limited nutrient removals	BOD-20 mg/l Suspended solids 30 mg/l, variable depending on season and efficiency of micro-strainers Nitrogen-17 mg/l Salinity-718 micromho/cm Fecal coliform-307/100m/ to 5621/100ml.	Same as above	No impact expected. Seepage expected from storage resarvoir but collection channel at perimeter should collect water. No seepage from lined lagoons.	Sa

IMPACT EVALUATION MATRIX

GROUND WATER QUALITY	PUBLIC HEALTH	ODOR	VISUAL	AGRICULTURAL	LAND USE	COST Present W High Low
No effect.	No improvement in potential recreational use of Poudre River for contact. If treatment efficiencies decrease, public health risks might increase slightly from First Ave. No impact from Evans and Hill' 'n Park.	Periodic odor generation from industrial wastes likely to impact area around First Avenue. Minimal impact from Evans and Hill 'n Park.	No Change.	Irrigators below dischargers would continue to benefit from nutrient and fertilizer effects. No new agricultural land or protection of agricultural land provided.	Would slow residential and commercial development in the Greeley area.	0
No Effect	Improves recreational aspects of Poudre R. for contact. Minimum threat to recreation to Platte due to improved treatment.	Long interceptor from First Avenue may develop odors that would be emitted at influent to plant. As long as aerobic conditions are maintained at plant no odor problems expected.	Extent of negative impact will be dependent on architectural design.	Loss of nutrients in wastewater to irrigators on lower Poudre, benefit to S. Platte irrigators. No new agriculture expected.	Acreage needed 40-45 acres 100 year flood hazard. Could slow residential development in Delta area.	31,1 29,
No impact expected. Seepage expected from storage reservoir but collect channel at perimeter. Should collect water. No seepage from lined lagoons.	Improved recreational aspects of Poudre R. for contact above Crow Creek. No benefit to Crow Creek or S. Platte below Crow Creek.	Interceptor from Greeley to lagoon potentially will develop odors that would be released at plant. Solids accumulation in reservoir may generate odor that would be released due to lowering water level during discharge. Aeration of lagoons should eliminate odor potential.	Visual impact will be greatest during construction. High effect at site and immediate, surrounding area.	Loss of nutrients to irrigators above Crow Creek confluence. No new agriculture expected.	Acreage needed: 80-90 acres for lagoon, 600 acres for storage reservoir. Will take some agricultural land out of production. Wildlife habitat potential.	37, 32,
No impact expected. Lining of lagoons will prevent seepage.	Same as above.	Interceptor from Greeley to lagoon potentially will develop odors that would be released at plant. Without reservoir potential for odors reduced. Aeration of lagoons should eliminate odor potential.	Visual impact will be greatest during construction. Limited effect visually at site.	Same as above.	Acreage needed: 80-90 acres for lagoon, no agricultural land taken out of production.	31, 28,
No impact expected. Seepage expected from storage reservoir but collection channel at perimeter should collect water. No seepage from lined lagoons.	Same as above.	Same as 24-day detention lagoon, storage reservoir discharge to Crow Creek option.	Similar to 24-day detention, storage reservoir, discharge to Crow Creek.	Same as above.	Acreage needed 20 acres for lagoon, 600 acres for storage reservoir. Will take some agricultural land out of production. Wildlife habitat potential.	37, 32,

CT EVALUATION MATRIX

WATER LITY	PUBLIC HEALTH	ODOR	VISUAL	AGRICULTURAL	LAND USE	COSTS Present Worth High Low
ffect.	No improvement in potential recreational use of Poudre River for contact. If treatment efficiencies decrease, public health risks might increase slightly from First Ave. No impact from Evans and Hill' 'n Park.	Periodic odor generation from industrial wastes likely to impact area around First Avenue. Minimal impact from Evans and Hill 'n Park.	No Change.	Irrigators below dischargers would continue to benefit from nutrient and fertilizer effects. No new agricultural land or protection of agricultural land provided.	Would slow residental and commercial development in the Greeley area.	0
ffect	Improves recreational aspects of Poudre R. for contact. Minimum threat to recreation to Platte due to improved treatment.	Long interceptor from First Avenue may develop odors that would be emitted at influent to plant. As long as aerobic conditions are maintained at plant no odor problems expected.	Extent of negative impact will be dependent on architectural design.	Loss of nutrients in waste water to irrigators on lower Poudre, benefit to S. Platte irrigators. No new agriculture expected.	Acreage needed: 40-45 acres 100 year flood hazard. Could slow residential development in Delta area.	31,123,150 29,847,150
pected. Seepage storage reser- ct channel at uld collect page from lined	Improved recreational aspects of Poudre R. for contact above Crow Creek. No benefit to Crow Creek or S. Platte below Crow Creek.	Interceptor from Greeley to lagoon potentially will develop odors that would be released at plant. Solids accumulation in reservoir may generate odor that would be released due to lowering water level during discharge. Aeration of lagoons should eliminate odor potential.	Visual impact will be greatest during construction. High effect at site and immediate, surrounding area.	Loss of nutrients to irrigators above Crow Creek confluence. No new agriculture expected.	Acreage needed: 80-90 acres for lagoon, 600 acres for storage reservoir. Will take some agricultural land out of production. Wildlife habitat potential.	37,582,400 32,429,900
expected. Lining ill prevent seep-	Same as above.	Interceptor from Greeley to lagoon potentially will develop odors that would be released at plant. Without reservoir potential for odors reduced. Aeration of lagoons should eliminate odor potential.	Visual impact will be greatest during construction. Limited effect visually at site.	Same as above.	Acreage needed: 80-90 acres for lagoon, no agricultural land taken out of production.	31,845,600 28,144,500
pected. Seepage m storage resar- llection channel should collect page from lined	Same as above.	Same as 24-day detention lagoon, storage reservoir discharge to Crow Creek option.	Similar to 24-day detention, storage reservoir, discharge to Crow Creek.	Same as above.	Acreage needed: 20 acres for lagoon, 600 acres for storage reservoir. Will take some agricultural land out of production. Wildlife habitat potential.	37,161,200 32,008,700

IMPACT EVALUATION

ALTERNATIVE	TREATMENT EFFICIENCIES	EFFLUENT QUALITY	SURFACE WATER QUALITY	GROUND WATER QUALITY	PUBLIC HEALT
24-day detention, 12 mgd. lagoon, reservoir storage, summer discharge Ogilvy ditch, winter discharge Crow Creek.	Primary and secondary treatment. Potential for limited nutrient removals in reservoir. Operation is simplified by minimal amount of mechanical equipment, however, winter-summer operational requirements increase. Solids removal infrequent.	BOD-30 mg/l Suspended solids 30 mg/l, variable depending on season and efficiency of micro-strainers Nitrogen-15.5 mg/l Salinity-718 micromho/cm Fecal coliform-307/100ML to 5621/ML	Removes discharge from Cache la Poudre. Winter discharge to Crow Creek not expected to significantly change water quality. Ogilvy Ditch water quality will change depending on amount of dilution available at discharge.	Degree of impact depends on percent of effluent in ditch, groundwater depth, and soils of land irrigated by Ogilvy Ditch. Reservoir seepage should be captured.	High public health ri sociated with 100% ef uncontrolled irrigation Improves recreational of Poudre. No benefit Creek or Platte.
24-day detention, 12 mgd lagoon, summer discharge Ogilvy Ditch, winter discharge Crow Creek.	Primary and secondary treatment. Minimal nutrient removal in lagoons. Operation is simplified by minimal amount of mechanical equipment, however, winter-summer operation requirements increase. Solids removal infrequent.	BOD-30 mg/l Suspended solids-30 mg/l, Variable depending on efficiency of micro-strainers Nitrogen-15.5 mg/l Salinity-657 micromho/cm Fecal coliform-30 day 6,000/100ml.	Same as above	Same as above.	Same as above.
4-day detention, 12 mgd. lagoon, reservoir storage, summer discharge Ogilvy Ditch, winter discharge Crow Creek.	Primary and secondary treatment, storage reservoir is integral part of treatment due to short detention time in lagoon. Minimal potential for nutrient removals. Operation is simplified by minimal amount of mechanical equipment, however, winter-summer operation and frequent solids removal increases operational requirements.	BOD-20 mg/l Suspended solids-30 mg/l, Variable depending on season and efficiency of micro-strainers. Nitrogen-17 mg/l Salinity-718 micromho/cm Fecal coliform-307/100ML to 5621/ML	Same as above.	Same as 24-day detention, reservoir storage Ogilvy-Crow Creek option.	Same as above.
24-day detention, 12 mgd lagoon, reservoir storage, land application, ground water collection, discharge to Crow Creek.	Primary, secondary, and tertiary treatment. Lagoon, reservoir, and soils are integral treatment components. High nutrient removals. Operation is less complex due to minimum of mechanical equipment, irrigation-storage functions increase operational requirements. Solids removal infrequent.	BOD-1-2 mg/l in captured groundwater Suspended solids-minimal to none Nitrogen-13.9 mg/l in captured groundwater Salinity-718 micromho/cm Fecal coliform-0-10/100m/ in captured groundwater	Removes discharge from Cache la Poudre R. New discharge to Crow Creek. Water quality in both streams should improve.	No impact expected. Seepage expected from storage reservoir but collection channel at perimeter should collect. Under drain at irrigation site should collect seepage.	Limited public he associated with spr tion provided adequ zone established. will be restricted edible crops. Cont fluent necessary to
4-day detention, 12 mgd. lagoon, reservoir storage, land application, ground water collection, discharge to Crow Creek.	Primary, secondary, and tertiary treatment. Lagoon, reservoir, and soils are integral part of treatment. Operation less complex than mechanical plant. However, irrigation-storage functions and frequent solids removal increase operational requirements.	Same as above.	Same as above	Same as above.	Same as abov

ACT EVALUATION MATRIX *(continued)*

D WATER ALITY	PUBLIC HEALTH	ODOR	VISUAL	AGRICULTURAL	LAND USE	COSTS Present Worth HIGH LOW
pact depends on effluent in ditch, depth, and soils gated by Ogilvy ervoir seepage ptured.	High public health risks associated with 100% effluent in uncontrolled irrigation ditch. Improves recreational aspects of Poudre. No benefit to Crow Creek or Platte.	Same as 24-day detention, lagoon, storage reservoir, discharge to Crow Creek.	Same as 24-day detention lagoon, storage reservoir, discharge to Crow Creek.	Nutrients are available for crops. Concentrations of nitrogen and salinity, even with 100 percent effluent will not be injurious to crops. No new agriculture expected.	Acreage needed 80-90 acres for lagoon, 600 acres for storage reservoir. Will take some agricultural land out of production. Wildlife habitat potential.	39,337,800 34,185,300
as above.	Same as above.	Same as 24-day detention lagoon, discharge to Crow Creek.	Same as 24-day detention lagoon, discharge to Crow Creek.	Same as above.	Acreage needed 80-90 acres for lagoon, no agricultural land taken out of production.	33,077,200 29,375,100
24-day detention, orage Ogilvy-Crow n.	Same as above.	Same as 24-day detention lagoon, storage reservoir discharge to Crow Creek.	Similar to 24-day detention, storage reservoir, discharge to Crow Creek.	Nutrients are available for crops. Concentrations of nitrogen and salinity, even with 100 percent effluent will not be injurious to crops. No new agriculture expected.	Acreage needed. 20 acres for lagoon, 600 acres for storage reservoir. Will take some agricultural land out of production. Wildlife habitat potential.	38,916,600 33,764,100
expected. Seepage om storage reser- collection channel er should collect. n at irrigation site ct seepage.	Limited public health risks associated with spray irrigation provided adequate buffer zone established. Irrigation will be restricted to non-edible crops. Control of effluent necessary to limit risks.	Same as 24-day detention lagoon, storage reservoir discharge. Aerobic conditions will prevent odors from land application site.	Same as 24-day detention, storage reservoir, discharge. Conversion of dry land to irrigated with buffer zone will be compatible with existing visual features.	Creates new irrigated agricultural land. Utilizes nutrients and water in crop productions. Protects agricultural use of land but reduces agricultural economy. Concentrations of nitrate should prove beneficial to corn or alfalfa. No effects expected to livestock.	Acreage needed: 80-90 acres for lagoon, 600 acres for storage reservoir. Some agricultural land taken out of production. 2,000-3,000 acres of rangeland put into production. Wildlife habitat potential.	37,424,800 32,272,300
as above.	Same as above.	Same as above	Same as above.	Same as above.	Acreage needed 20 acres for lagoon, 600 acres for storage reservoir. Some agricultural land taken out of production. 2,000-3,000 acres of rangeland put into production. Wildlife habitat potential.	37,003,600 31,851,100

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Introduction

The City of Greeley has been planning for the upgrading and expansion of their wastewater treatment facilities since 1972. The City has applied to the Environmental Protection Agency (EPA) for grant monies for the design and construction of these facilities under Public Law 92-500, the Clean Water Act. This law specifies a three-step approach to such projects:

Step 1 - Facility Plan
Step 2 - Design Plans and Specifications
Step 3 - Construction

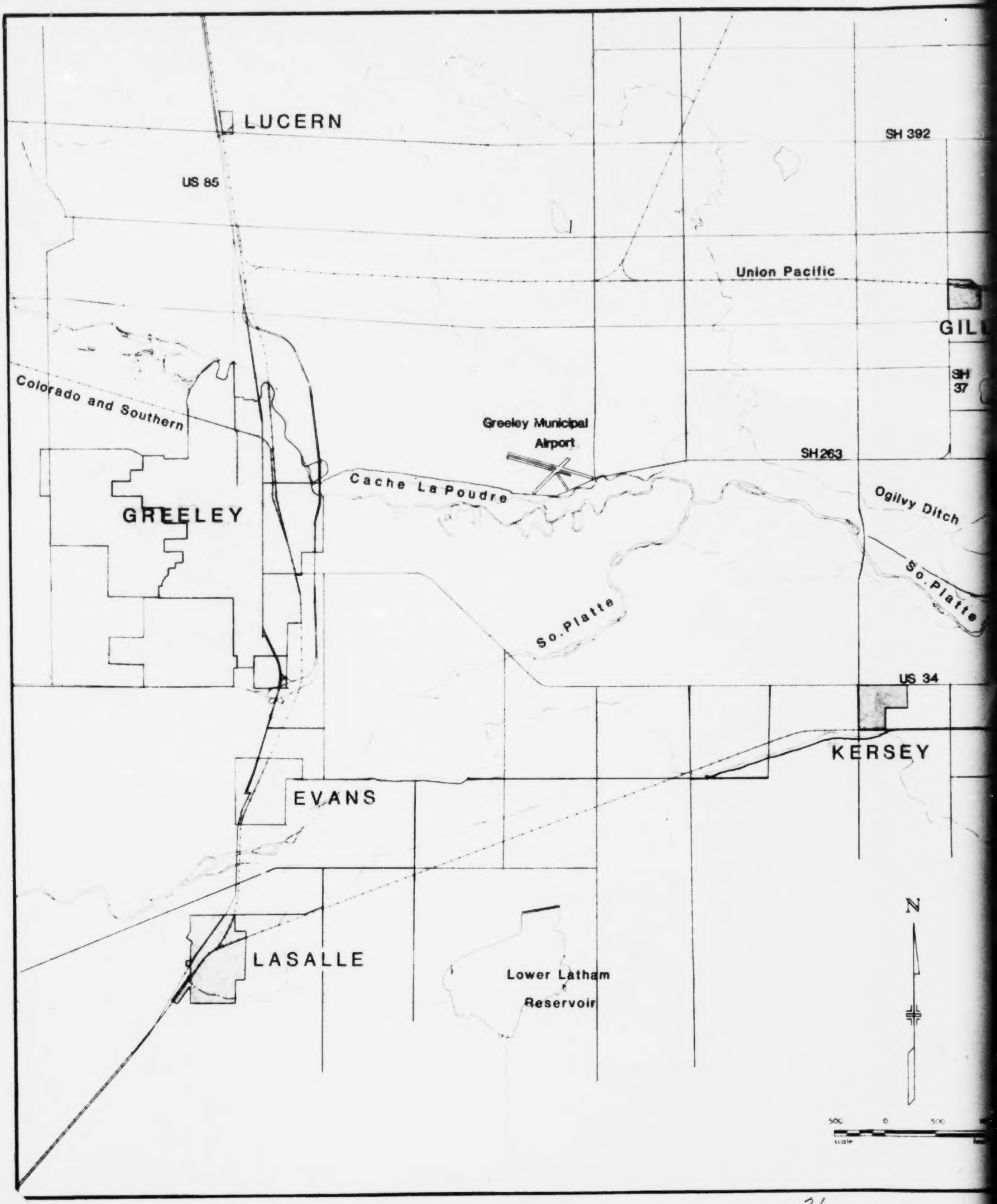
The City received Step 1 funding from EPA and a facility plan was completed in 1975. After completion of this study, the Greeley Water Board recommended that the City Council proceed with the design and construction of a new "mechanical" treatment plant at a location east of the City known as the "Delta" site. The new facility was to be built in modular fashion and the North Side Facility at First Avenue was to be upgraded and operated until approximately 1990.

EPA, partially as a result of local opposition, prepared an environmental impact statement on the project. The EIS was completed in 1976 and the adopted plan was accepted by the Colorado Water Quality Control Commission and EPA.

An application for Step 2 funding was subsequently approved by EPA for the design of these facilities. However, revised construction cost estimates were prepared which were approximately three times those contained in the facility plan. Because of this fact along with continued local opposition and a new national emphasis on alternative treatment systems, the city decided to study additional alternatives which had not been considered in the original facility plan. A request for funding for a supplement study to the original facility plan was then approved by EPA. Since new alternatives were being addressed, a supplement to the original EIS was also required.

The base map in Exhibit 1 shows the Greeley region and the new study area.

East of the study area is a continuation of rangeland.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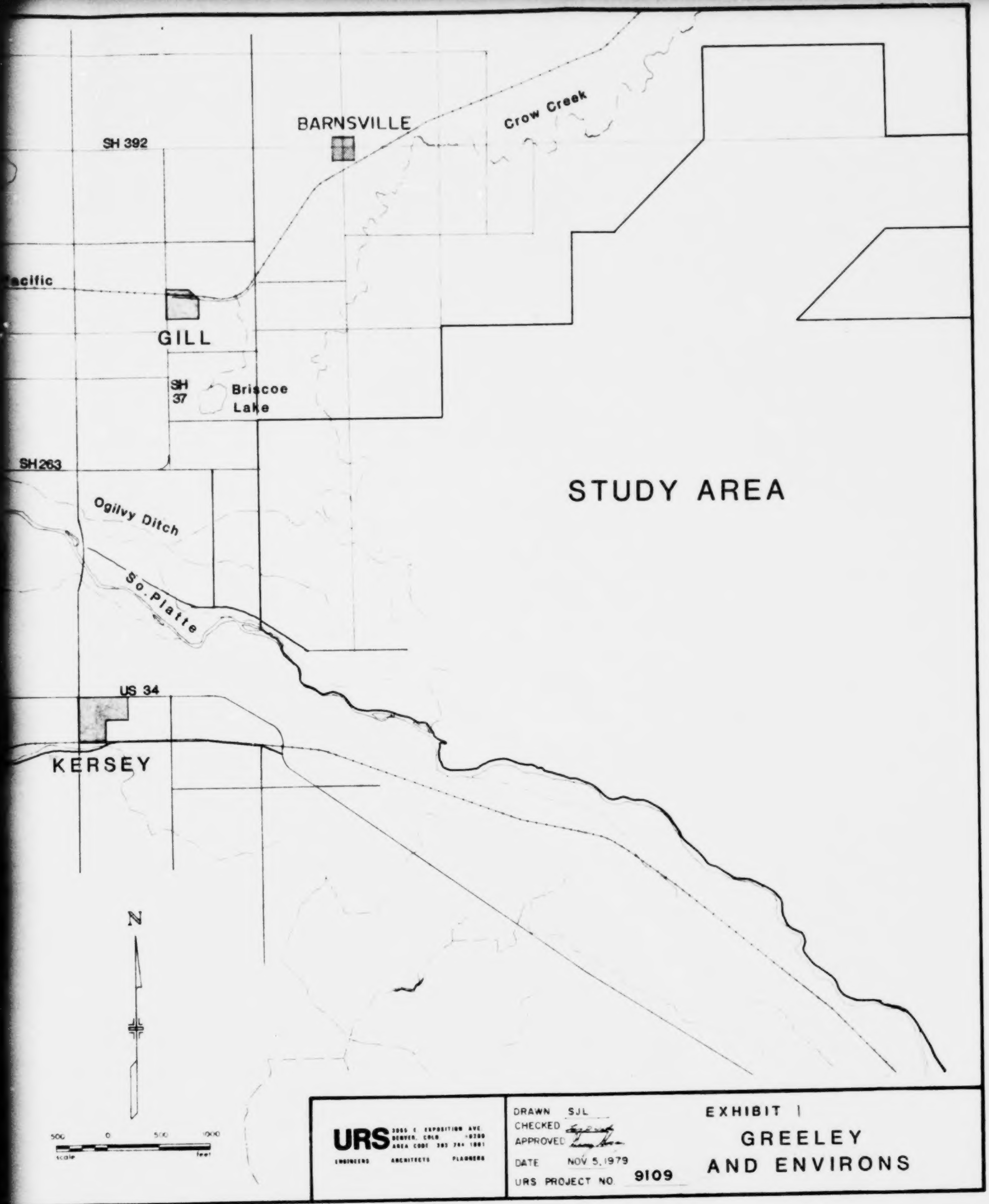
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EXHIBIT 1

GREELEY AND ENVIRONS

Purpose of and Need for Action

Latest population projections indicate that the First Avenue facility is not adequate to satisfy future demand for wastewater treatment. Additionally, parts of the existing facility are quite old (1936) and are inefficient. This plant will not consistently attain the water quality requirements set forth in the Federal Water Pollution Control Act Amendment of 1972.

For these reasons, a new facility is needed. In conjunction with the planning for this facility, an environmental impact statement is required under the conditions of the National Environmental Policy Act of 1969 (NEPA).

An EIS is required when the agency finds that a project may have a significant impact on the environment. An EIS was recommended for Delta site alternative and the new alternatives thus require a supplemental EIS.

This supplement to the original EIS is designed to inform all interested parties of the anticipated impacts associated with the project.

DESCRIPTION OF ALTERNATIVES

No Action Alternative

Introduction

Historically, the First Avenue plant has had operational problems leading to both water pollution and odor problems. Operational problems were attributed, in part, to the combination of Greeley's domestic sanitary waste with Monfort's very high strength industrial waste for treatment at the First Avenue plant. In addition to the combined waste problem, the sewage treatment plant operators were not adequately trained to operate the complex design of the First Avenue plant.

In 1973, the Monfort waste was separated from Greeley's domestic waste and treated at the new Lone Tree Creek plant. Personnel changes along with removal of the Monfort waste resulted in significant improvements in the First Avenue plant performance. The BOD and suspended solids averaged approximately 62 parts per million (ppm) in 1974, and were reduced to a 34 ppm average in 1975 (EPA's secondary treatment requirements designated a 30 ppm average for BOD and suspended solids). The plant performance during the last half of 1975 was in compliance with secondary treatment standards. However, the plant has not consistently maintained these standards. In the first half of 1979, BOD and suspended solids standards were slightly exceeded in two monthly periods.

The lagoon plant was constructed in 1972 with a design for a flow load of 2.77 million gallons per day and 35,000 pounds of five-day BOD, which is a BOD concentration more than six times average domestic sewage. Major problems in operating the lagoon are associated with the objectionable odors that have come from the anaerobic ponds.

Existing Environment - Agriculture

Weld County in general and the Greeley area in particular has some of the most productive farmland in the State of Colorado. The County accounts for almost 16% of the state's crop value, more than two and one half times any other county. Table 1 shows crop value of production for Weld County and the state.

TABLE 1

Crops: Value of Production for Weld County and the State in Thousand Dollars

		All Wheat	Corn	Barley	Dry Beans	Other Crops	All Crops
1978	Weld	9,845	49,020	4,130	5,120	44,398	112,513
	Colo.	157,073	244,331	33,792	25,857	276,796	737,849
1977	Weld	6,735	47,964	4,267	5,235	43,867	108,068
	Colo.	121,542	221,743	31,890	23,655	278,406	677,236
1976	Weld	9,631	55,409	3,879	3,512	46,985	119,416
	Colo.	125,696	218,954	29,241	19,481	312,202	705,754

Source: 1979 Colorado Agricultural Statistics
Colorado Department of Agriculture

The productivity of agriculture in Weld County has provided a strong economic base for the Greeley area since the late 1800's. The significance of Weld County's agricultural economic base is indicated in the statistics that place the county first in agricultural productivity in Colorado and second in the nation. The value of all crops produced in the region was approximately $173 million in 1975 (1). Of the total value of Weld County's agricultural production approximately 75 percent is attributed to the feeder cattle industry, followed by dairy products.

In the 27 year period from 1950 to 1977, Colorado Agricultural Statistics shows an increase in the acreage planted in corn and wheat (2), while other crops have gradually declined. During this same period, yields per acre for all crops have increased. This may be attributed to more efficient farm management practices and advances in agricultural technology.

The irrigation of farmland is the primary reason that the county is one of the top agricultural producing counties in the nation. All methods of irrigation are practiced in the Greeley area, except where slope is a limiting factor. There is a trend, where feasible, to replace furrow irrigation with sprinklers. The two major reasons for this trend are to increase water application efficiencies, and to decrease labor costs. Soils, availability of water, and climate are features that contribute to the overall productivity.

SOILS

Soils of the area generally are representative of the tertiary and pleistocene sediments along the eastern edge of the Rocky Mountains. Recent alluvial deposits occur along the stream valleys. Soils can be grouped into the following general categories: high terrace and alluvial fan soils, old terrace and plains soils, ridgecrest and slope soils, upland soils, flood plain soils, and the sandhill area soils. The Soil Conservation Service (SCS) has conducted detailed soil surveys for Weld County which have not been published (33). In general, soils of the study area are well suited for crop production. The major soils of the study area are sandy in texture, with clays and loams.

Soil Productivity

Soil fertility is naturally low within the area. Nitrogen, and to a lesser degree phosphorus is needed for top crop production in the irrigated areas. Lime and iron are also known to be deficient in many of the soils. Most irrigation water contains enough of the minor elements to meet the annual requirements of commonly grown crops.

Cropping Patterns and Yields

The irrigated farmland within the area produces a variety of crops. Some of the more economically significant crops include corn for grain, corn for silage and alfalfa. A common cropping system is a three to four year rotation of alfalfa and corn. This type of rotation allows maximum utilization of available soil nutrients. Crop yields are presented in Table 2 along with an estimate of the 1979 market value.

TABLE 2

Estimated Crop Yields and Values

Crop	Yield Per Acre[1]	1979 Market Value[2]
Alfalfa	4 tons	$40.50/ton
Corn (grain)	100 bushels	2.74/bushel
Corn (silage)	16 tons	18.31/ton

[1] Weld County Extension Service

[2] From Northglenn Feed and Bean, Western Alfalfa Corporation, Farmers Marketing Association, and Monfort Farms.

Irrigation Practices in the Project Area

All methods of irrigation are practiced in the Greeley area. Slope and soil type are the main factors in determining the type of irrigation system utilized. Furrow and center pivot sprinklers are the more common types practiced.

Furrow irrigation is accomplished by gravity flow of water in narrow channels fed by a head ditch. Water seeps into the soils from the sides and bottom of the furrows. Water is introduced into each furrow by a siphon tube from the head ditch.

Rotating center pivot sprinklers pump water through a rotating boom which has sprinkler heads attached. Water is sprayed from the sprinklers as the arm rotates over the crop. Typical coverage of one pivot is 140 acres. Application rates vary, depending on precipitation, crop, and soil. According to the Weld County Extension Service (34), there is a trend to replace furrow irrigation with sprinklers. The two major reasons for this trend are to increase water application efficiencies and to decrease labor cost.

Irrigation Water Demand

Water requirements for irrigation have been estimated using the Modified Blaney-Criddle formula (35). This method gives an estimate of actual evapotranspiration for irrigated areas of semi-arid and arid regions based on correlations with existing irrigation practice. The estimated consumptive use effective precipitation, and irrigation water requirement for corn (silage), corn (grain), and alfalfa are presented in Table 3. These data (presented in Table 3) were developed from information for the period of January 1931 through December 1978.

TABLE 3

Average Crop Water Use-Greeley, Colorado (35)
Annual Inches

Crop	Consumptive Use In.	Effective Precipitation In.	Irrigation Requirement Ft.
Corn (silage)	22.406	4.435	1.500
Corn (grain)	22.898	4.467	1.533
Alfalfa	31.431	5.946	2.124

Source: Arix, Wastewater Facilities Planning Report No. 1. Evaluation of Alternatives for Greeley Colorado, Volume II, Appendices, August 1979.

This period includes two dry cycles experienced during the early 1930's and during the middle 1950's.

Water Quality Requirements for Agricultural Irrigation

Irrigation water quality is evaluated on these main criteria: salinity, sodium hazard, toxicity and pH. The degree of severity of problems potentially caused by using irrigation waters of various quality are identified in Tabie 4. Although values given in this table are proven to be applicable under most conditions, site specific conditions (such as leaching fraction, drainage conditions, irrigation method, soil conditions, and tolerance to salinity of crops) can modify the values. Thus, with an increase in leaching fraction, waters with somewhat higher salinity may be used with little or no problem. Also, with good drainage conditions, salt buildups and permeability problems are less prevalent.

Livestock Watering Requirements

Studies conducted to relate water quality to livestock health are relatively few in number. In general, animals can tolerate higher salinities than human beings. Tolerance of animals to water quality parameters depends upon many factors including the salt content of the diet and the nature of the salts involved. Tables 5 and 6 provide a set of recommendations for maximum levels of various elements in drinking water supplies for livestock.

POPULATION

The Greeley region has been experiencing substantial growth which is expected to continue. Between 1960-1970, City population increased 47.8%. The 1978 population stood at 60,250. Projecting population figures to the year 2000 has led to varying estimates. The Colorado Division of Planning gives a low figure of 81,233 and a high of 99,171. Weld County Planning is projecting 114,764. The 1978 Needs Survey Wastewater Systems Inventory projects 112,154 persons served by a treatment plant in the Greeley region by the year 2000.

TABLE 4

GUIDELINES FOR INTERPRETATION OF WATER QUALITY FOR IRRIGATION

Problem area criterion	Degree of severity of problem		
	None	Increasing	Severe
Salinity			
Electrical conductivity, ECw (mmhos/cm)	0.75	0.75 to 3.00	3.00
Soil permeability			
Electrical conductivity, ECw (mmhos/cm)	0.50	0.50 to 0.20	0.20
Adjusted SAR[a]	6.00	6.00 to 24.00	24.00
Toxicity			
Sodium[b] (adj SAR)	3.00	3.00 to 9.00	9.00
Chloride[b] (meq/1)	4.00	4.00 to 10.00	10.00
Boron (mg/1)	0.75	0.75 to 2.00	2.00
Miscellaneous			
Nitrogen: No_3 or NH_4 (mg/1)	5.00	5.00 to 30.00	30.00
Bicarbonates[c], HCO_3 (meq/1)	<1.50	1.50 to 8.50	> 8.50
pH		(Safe Range 6.50 to 8.00)	

[a] Adjusted SAR can be calculated from the formula presented in text. The medium range is amenable to further interpretation with knowledge of type of clay minerals in soil.

[b] Principally applicable to tree crops and woody ornamentals. For annuals, see text.

[c] Significant in sprinkler irrigation.

Source: Ayers, R.S. and Westcot, D.W.
"Water Quality for Agriculture"
Food and Agriculture Organization of the United Nations, Rome 1976.

TABLE 5

GUIDE TO THE USE OF SALINE WATERS FOR LIVESTOCK AND POULTRY

Total Soluble Salts Content of Waters(mg/l)	
Less than 1 000 mg/l (EC < 1.5)	Relatively low level of salinity. Excellent for all classes of livestock and poultry.
1 000 - 3 000 mg/l (EC = 1.5 - 5)	Very satisfactory for all classes of livestock and poultry. May cause temporary and mild diarrhea in livestock not accustomed to them or watery droppings in poultry.
3 000 - 5 000 mg/l (EC = 5 - 8)	Satisfactory for livestock, but may cause temporary diarrhea or be refused at first by animals not accustomed to them. Poor waters for poultry, often causing water feces, increased mortality and decreased growth, especially in turkeys.
5 000 - 7 000 mg/l (EC = 8 - 11)	Can be used with reasonable safety for dairy and beef cattle, for sheep, swine and horses. Avoid use for pregnant or lactating animals. Not acceptable for poultry.
7 000 - 10 000 mg/l (EC = 11 - 16)	Unfit for poultry and probably for swine. Considerable risk in using for pregnant or lactating cows, horses, or sheep, or for the young of these species. In general, use should be avoided although older ruminants, horses, poultry, and swine may subsist on them under certain conditions.
Over 10 000 mg/l (EC > 16)	Risks with these highly saline waters are so great that they cannot be recommended for use under any condition.

Source: Environmental Studies Board, Nat. Acad. of Sci., Nat. Acad. of Eng. Water Quality Criteria 1972

TABLE 6

RECOMMENDATIONS FOR LEVELS OF TOXIC SUBSTANCES IN DRINKING WATER FOR LIVESTOCK

Constituent	Upper limit
Aluminum (al)	5 mg/1
Arsenic (As)	0.2 mg/1
Beryllium (Be)	No data
Boron (B)	5.0 mg/1
Cadmium (Cd)	.05 mg/1
Chromium (Cr)	1.0 mg/1
Cobalt (Co)	1.0 mg/1
Copper (Cu)	0.5 mg/1
Fluoride (F)	2.0 mg/1
Iron (Fe)	No data
Lead (Pb)[a]	0.1 mg/1
Manganese (Mn)	No data
Mercury (Hg)	.01 mg/1
Molyodenum (Mo)	No data
Nitrate + Nitrite (NO_3-N+NO_2-N)	100 mg/1
Nitrite (NO_2-N)	10 mg/1
Selenium (Se)	0.05 mg/1
Vanadium (V)	0.10 mg/1
Zinc (Zn)	24 mg/1
Total Dissolved Solids (TDS)	10,000 mg/1

[a] Lead is accumulative and problems may begin at threshold value = 0.05 mg/1

Source: Environmental Studies Board
"Water Quality Criteria 1972"
National Academy of Science, National Academy of Engineers.

LAND USE

The original study area consisted of approximately 40,000 acres. The original EIS accounted for five unique land use configurations. They were:

1. The high percentage - 32.8% - of the city's land in streets and highways, which is the result of 100-foot wide streets developed by the original planners of Greeley in 1870;
2. significant amounts of vacant land available for development;
3. commercial strip development south of the city on U.S. 85 and the more recent development west on U.S. 34;
4. the north-south corridor of industrial land use on the east side of the city, and
5. continued residential growth south and west of the city.

This residential growth has been taking some farm land out of production west of the city. As residential growth spreads, the importance of the central city to the commercial interests of the area declines. Primarily, this is due to an increase in shopping centers and other small commercial nodes, which are designed to service small residential jurisdictions.

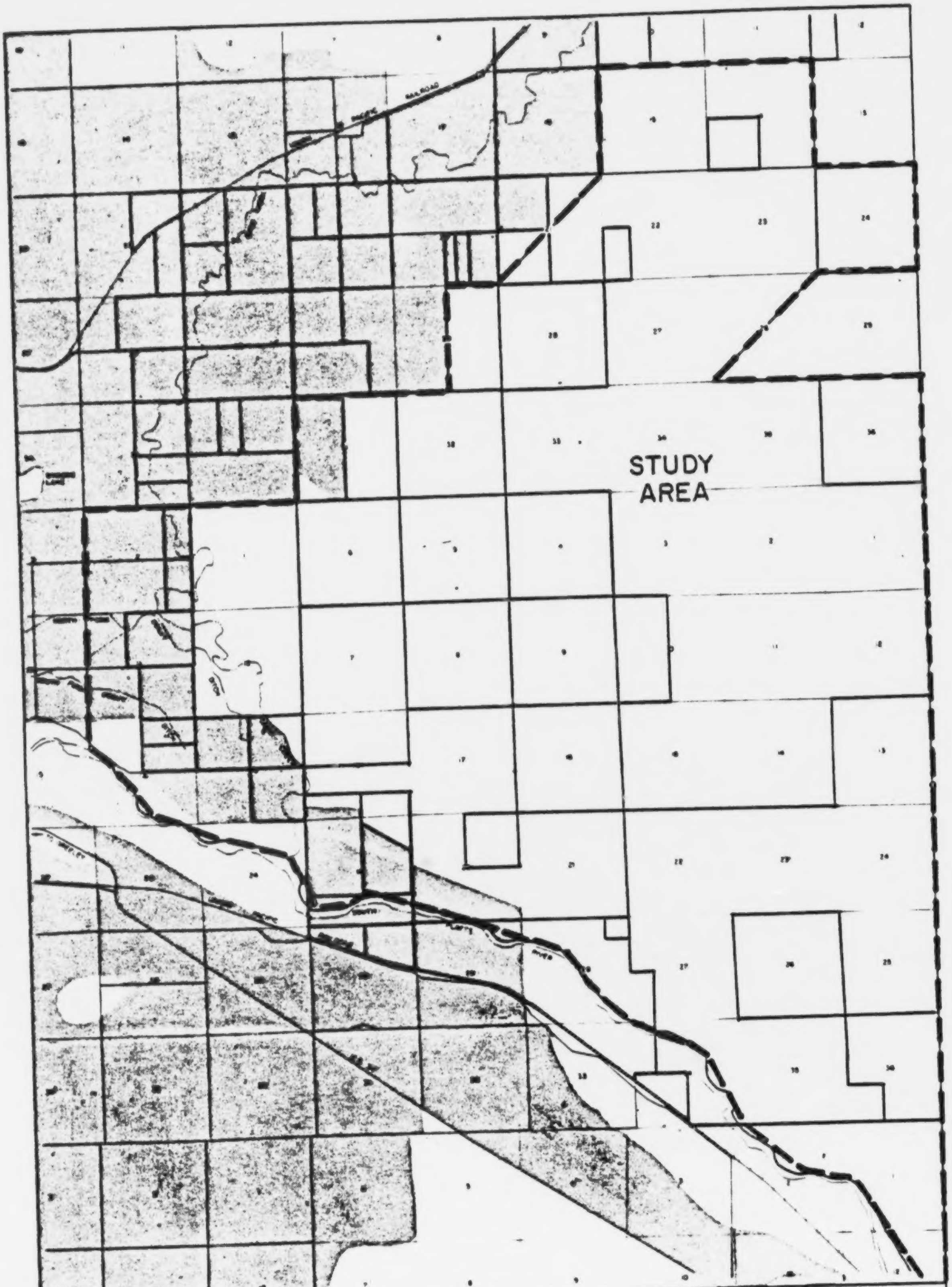
The land use patterns of the current study area are agricultural. The entire area is approximately 44 square miles. However, no more than 5,000 acres would be actually utilized for treating the effluent. Exhibit 2 shows current land use and land ownership. As can be seen in this exhibit, the acreage under consideration is presently non-irrigated. The irrigated farm land currently under cultivation borders the study area. These lands are irrigated by water drawn from the Ogilvy Ditch and other canals owned by the Cache la Poudre Irrigation Company. Exhibit 3 shows residence and well locations.

CULTURAL RESOURCES

A cultural resources inventory report was prepared for the study area by Gorden and Kranzush, Inc. This report, conducted for the 201 facilities plan, sampled land within the study area to determine the potential impacts to cultural resources. Cultural activities that were found to exist included tool manufacturing, game or vegetal food activities and hunting.

Historic sites in the general area include:

- The grave of the first permanent settler of Weld County
- Twin Buttes Campground
- Hardin (1906)
- Kuner (1908)
- Various stage coach routes and trails



LEGEND

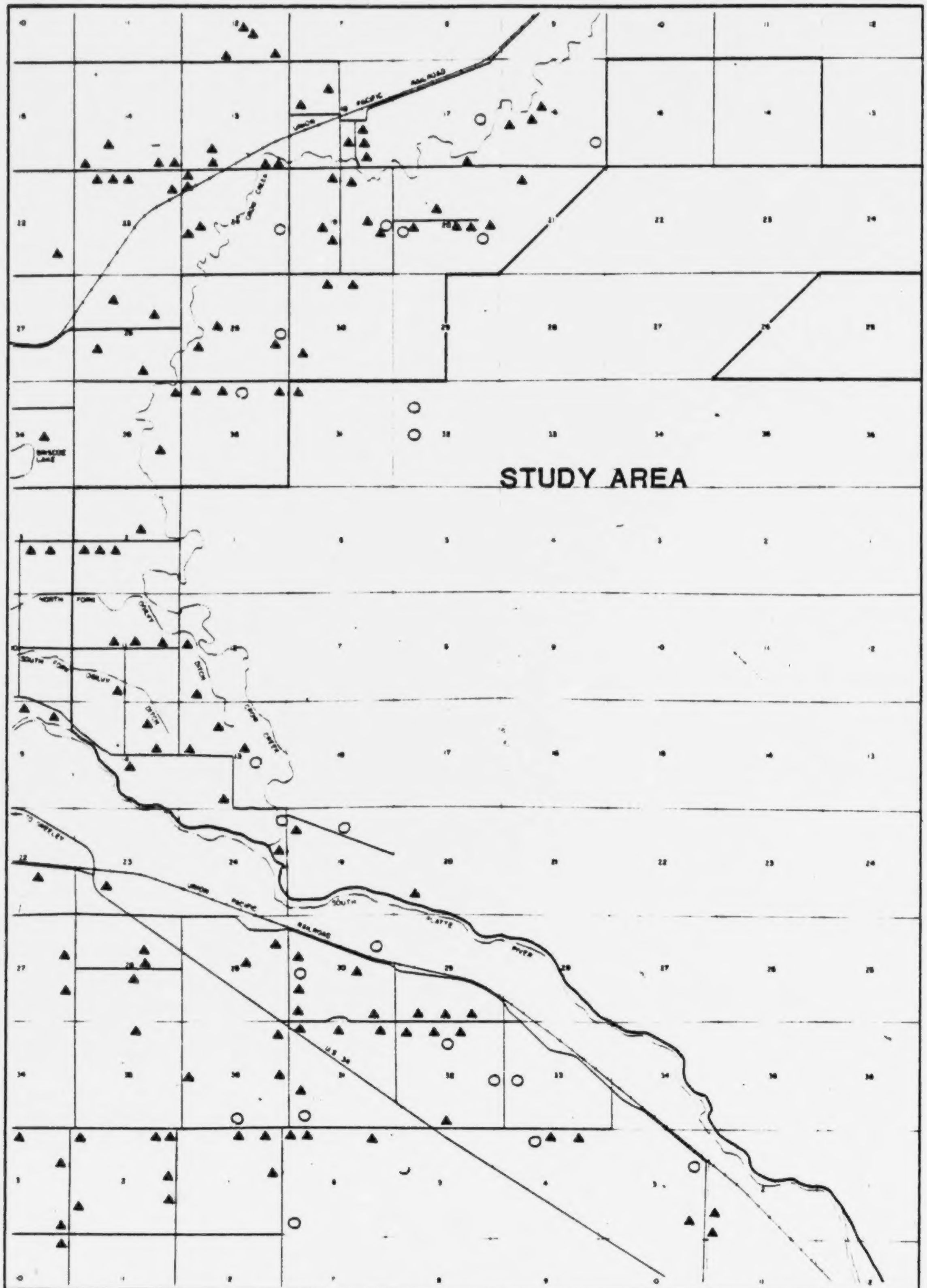
- ▨ Irrigated Land
- — Property Boundary
- ▬ ▬ Study Area Boundary

URS

MAP TAKEN FROM GREELEY 201 STUDY BY ARIX CORP

EXHIBIT 2

IRRIGATED & NONIRRIGATED LAND WITH PROPERTY BOUNDARIES


STUDY AREA
UNION PACIFIC RAILROAD
NORTH FORK
SOUTH FORK
SOUTH PLATTE RIVER
TO GREELEY
U.S. 34

▲ **RESIDENCE**

○ **WELL**

URS 3000 E. EXPOSITION AVE.
DENVER, COLO. 80209
AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

MAP TAKEN FROM
GREELEY 201 STUDY
BY ARIX CORP

EXHIBIT 3

RESIDENCE AND
WELL LOCATION

No sites within the study area are listed on the National Register of Historic Places (NRHP). The Office of the State Archaeologist lists one prehistoric site in the study area. It is a campsite of unknown age, cultural affiliation and significance located in Section 4, Township 5 North, Range 63 West, site 5 WL183.

There were no surface artifacts considered unique or of particular scientific value. A possibility does exist for potential eligibility for the NRHP. This is based on some of the artifacts only partially exposed to the surface at Site 5 WL426 indicating other possible cultural remains beneath the surface. This site could have possibly served various functions. These include tool manufacturing, food processing and camping. Further examination of this site might be necessary to determine the degree of impact the land application alternative might have on this potential cultural resource.

WATER QUALITY

Water Quality Criteria

The proposed Colorado water quality criteria are used to evaluate the existing water quality. The water supply criteria pertain to ground water quality which may be adversely affected, rendering it unsuitable as a water supply. The recreational criteria is considered because of potential public health risks associated with contact with the wastewater. The agricultural criteria is important when assessing water quality effects on crop and livestock production. The pertinent criteria limits for these uses are presented in Table 7. The Colorado Department of Health defines these various uses in Appendix A.

Surface Water Quality

Surface water quality data are available for the South Platte River, Cache la Poudre and Crow Creek. Data are not available for Ogilvy Ditch; however, it is assumed that the water quality of the Cache la Poudre River below Greeley's First Avenue wastewater treatment plant is representative of the Ogilvy Ditch. The Ogilvy Ditch headgate is downstream of the treatment plant discharge.

Water quality problems in the Cache la Poudre River are associated with fecal coliform, ammonia, and sulfate. Fecal coliform concentrations range from 2.2/100 ml to 2.4 x 10^6/100 ml with a mean value of 51,416/100 ml. The mean value violates the water supply and recreational criteria. Mean concentrations of ammonia above and below the First Avenue wastewater treatment plant (2.35 mg/l and 1.9 mg/l respectively) exceed the water supply criterion. Mean values of sulfate (647 mg/l) in the Cache la Poudre exceed the water supply criterion.

TABLE 7

WATER QUALITY PARAMETERS AND CRITERIA

Category	Parameter	Use Water Supply	Recreation Class I	Recreation Class II	Agriculture
Physical	Temperature, °C	-	-	-	-
	pH, units	5.0 - 9.0	6.5 - 9.0	-	-
	Dissolved Oxygen, mg/l	aerobic	aerobic	aerobic	aerobic
	Alkalinity, mg/l-$CaCO_3$	-	-	-	-
	Color	free from	free from	free from	free from
	Turbidity, TU	-	-	-	-
	TDS, mg/l	-	-	-	-
	TSS, mg/l	-	-	-	-
	TVS, mg/l	-	-	-	-
	Settleable solids, mg/l	-	-	-	-
	Hardness	-	-	-	-
	Conductivity, mmhos	-	-	-	-
Nutrients/ Organics	Phosphate, mg/l	-	-	-	-
	Phosphorus	-	-	-	-
	Ortho-phosphate, mg/l	-	-	-	-
	Nitrate-N, mg/l	10	-	-	100
	Nitrite-N, mg/l	1.0	-	-	10
	COD, mg/l	-	-	-	-
	BOD, mg/l	-	-	-	-
	Organic Nitrogen, mg/l	-	-	-	-
	TKN	-	-	-	-
Biological	Total Coliform, #/100 ml	-	-	-	-
	Fecal Coliform, #/100 ml	2000	200	2000	-
Toxics	Ammonia-N, mg/l	0.5	-	-	-
	Fluoride, mg/l*				
	Cyanide, mg/l	0.2	-	-	0.2
Metals	Aluminum, mg/l	-	-	-	-
	Arsenic, mg/l	0.05	-	-	0.1
	Cadmium, mg/l	0.01	-	-	0.01
	Chromium, mg/l	0.05	-	-	0.1
	Copper, mg/l	1.0	-	-	0.2
	Iron, mg/l (dissolved)	0.3	-	-	-
	Lead, mg/l	0.05	-	-	0.1
	Magnesium, mg/l	-	-	-	-
	Manganese, mg/l (dissolved)	0.05	-	-	0.2
	Molybdenum, mg/l	-	-	-	-
	Selenium, mg/l	0.01	-	-	0.02
	Zinc, mg/l	5.0	-	-	2.0
Inorganic Minerals	Chloride, mg/l	250	-	-	-
	Sodium, mg/l				
	Sulfate, mg/l	250	-	-	-
	Calcium, mg/l	-	-	-	-
	Boron, mg/l	-	-	-	0.75

*Fluoride levels vary based on annual average of the maximum daily air temperature.

Criteria for fecal coliform and sulfate are exceeded in Crow Creek. Fecal coliform concentration is 4200/100 ml and sulfate has a concentration of 800 mg/l.

A total of 47 parameters have been monitored. These data are summarized in Table 8.

The Cache la Poudre and South Platte rivers in the study area are currently classified B_2 waters. This classification is comparable to a warm water fishery and Class II recreational stream using the Use Classification establishing water standards. Crow Creek is currently unclassified. Stream classifications in the study area will not be updated until the spring of 1980.

Use of the streams in the study area are primarily for agriculture. Crow Creek is almost exclusively an agricultural stream, receiving infrequent recreational use. The Cache la Poudre and South Platte rivers have a slightly higher recreational potential. This is a function of the greater volumes of water carried by these rivers year round.

Groundwater Quality

Groundwater quality data are available for the South Platte and Cache la Poudre alluvial aquifers; additional data are also available at the proposed agricultural site.

Groundwater quality data are limited in the tributary aquifers along the South Platte River and the Cache la Poudre. The available data indicate that the groundwater quality is poor. Concentrations of nitrate and sulfate exceed the water supply criteria of 10 mg/l and 250 mg/l, respectively. High total dissolved solids (TDS) and conductivity indicate the groundwater is saline in composition.

Groundwater at the proposed agricultural site varies from well to well but generally is of a better quality than the tributary aquifers. With the exception of a shallow well (40 feet deep), nitrate concentrations are below the water supply criterion. The deeper groundwater (160 feet deep) is generally less saline than the tributary aquifers of the South Platte and Cache la Poudre Rivers. Data from the tributary groundwater is probably part of this groundwater system.

Public Health

Public health hazards can be a major concern when considering land disposal of treated effluents and sludge. Potential health risks associated with land applications of wastewater are:

- human contact with the effluent
- irrigation of raw edible food crops with the effluent.

TABLE 8

WATER QUALITY SUMMARY

Parameter	Recreation WS	Recreation Class I	Recreation Class II	Agriculture	South Platte Mean	South Platte Maximum	South Platte Minimum	Cache La Poudre Mean	Cache La Poudre Maximum	Cache La Poudre Minimum	Cache LaPoudre Above Treatment Plant	Crow Creek Mean	Crow Creek Maximum	Crow Creek Minimum
Temperature °C	-	-	-	-								28		
pH, units	5.0-9.0	6.5-9.0	-	-	7.9	9.3	4.5	7.9	8.7	6.5	7.8	8.1	8.2	8.0
Dissolved Oxygen mg/l	---------------aerobic---------------				9.3	14.4	5.6	10.1	13.0	5.8				
Alkalinity as $CaCO_3$ mg/l	-	-	-	-	185	270	100	182.0	280.0	84.0	227.5	350		
Color	--------------free from--------------													
Turbidity, TU	-	-	-	-	35.9	218	4.0	26.2	510.0	1.2		3720		
TDS, mg/l	-	-	-	-	1049	1435	438	1318	1638	298		47		
TSS, mg/l	-	-	-	-										
TVS, mg/l	-	-	-	-										
Settleable Solids, mg/l	-	-	-	-										
Hardness	-	-	-	-	577	730	176	728	900	151	730	>1000		
Conductivity, micro mhos/cm	-	-	-	-	1479	2070	531	1633	2280	461	610	1480		
Phosphate	-	-	-	-	2.7	7.9	0.1	2.9	6.8	0.2				
Phosphorus	-	-	-	-	0.7	2.3	0.0	0.89	2.6	0.0		0		
Ortho-phosphate mg/l	-	-	-	-							5.0	0		
Nitrate-N, mg/l	10	-	-	100	4.6	21.0	0.3	4.4	9.3	0.4	32.5	4.6	5.2	4.0
Nitrite-N, mg/l	1.0	-	-	10	0.11	0.91	0.0	0.16	0.52	0.01		0.05	0.1	0.0
COD mg/l	-	-	-	-				2.0	2.0	2.0				
BOD mg/l	-	-	-	-	8.2	79.0	1.0	9.7	79.0	2.0				
Organic Nitrogen mg/l	-	-	-	-							10-15	2.1		
TKN mg/l	-	-	-	-	23.1	40.1	6.3	9.7	9.7	9.7				
Total Coliform #/100 ml	-	-	-	-	14921	2.3×10^5	93	80820	2.3×10^6	22				
Fecal Coliform #/100 ml	2000	200	2000	-	15321	2.4×10^5	15	51416	2.4×10^6	2.2		4200		
Ammonia-N, mg/l	0.5	-	-	-	1.2	8.7	0.0	1.9	8.0	0	2.35	0.0		
Fluoride, mg/l					0.97	1.2	0.8	0.75	1.1	0.23				
Cyanide, mg/l	0.2	-	-	0.2	0.0	0.0	0.0	0.0	0.0	0.0				
Aluminum, mg/l	-	-	-	-	0.005	0.005	0.005	0.004	0.004	0.004				
Arsenic, mg/l	0.05	-	-	0.1	0.0	0.0	0.0	0.0	0.0	0.0				
Cadmium, mg/l	0.01	-	-	0.01	0.001	0.027	0.0	0.00005	0.0006	0.0				
Chromium, mg/l	0.05	-	-	0.1	0.013	0.12	0.0	0.0006	0.006	0.0				
Copper, mg/l	1.0	-	-	0.2	0.015	0.18	0.0	0.0068	0.034	0.0				
Iron, mg/l (dissolved)	0.3	-	-	-	1.4	6.2	0.1	0.77	4.7	0.05				
Lead, mg/l	0.05	-	-	0.1	0.006	0.023	0.0	0.003	0.025	0.0				
Magnesium, mg/l	-	-	-	-	567	130	2.0	67.9	120.0	10.0	220			
Mangenese, mg/l (dissolved)	0.05	-	-	0.2	0.181 (Total)	0.4	0.05	0.187 (Total)	0.55	0.0				
Molybdenum, mg/l	-	-	-	-	0.011	0.03	0.0	0.002	0.01	0.0				
Selenium, mg/l	0.01	-	-	0.02	0.001	0.007	0.0	0.0019	0.009	0.0				
Zinc, mg/l	5.0	-	-	2.0	0.11	1.0	0.0	0.04	0.13	0.0				
Chloride, mg/l	250	-	-	-	57	96	10	40.3	59.0	8.0	40			
Sodium, mg/l	-	-	-	-	127	195	46	117	260	10	38.4			
Sulfate, mg/l	250	-	-	-	538	690	220	647	780	170	500	800		
Calcium, mg/l	-	-	-	-							202			
Boron, mg/l	-	-	-	0.75	0.27	0.47	0.0	0.21	0.38	0				
SAR	-	-	-	-	2.3	3.8	0.9	1.9	3.8	0.6	0.6			
Total Solids, mg/l	-	-	-	-								1600		
Calcium as $CaCO_3$ mg/l	-	-	-	-	345	517	2.7	452	707	120	200			
Potassium, mg/l					7.0	8.0	6.0	9.0	12.0	5.0				

Pathogenic organisms have been identified in domestic sewage including bacterial, virus, worms, and protozoas. Traditionally, total coliform bacteria have been used to indicate the possible presence of disease causing organisms. However, it has been found that the fecal coliform bacteria is a more specific indicator of the potential presence of disease causing pathogens.

The draft water quality criteria, proposed by the Colorado Department of Health, recommended fecal coliform criterion for agriculture, of 1000/100 milliliters (ml). This value was based on the recommended criterion presented in the National Academy of Science report (6) and represents an ambient in-stream condition. In Colorado's final proposed water quality criteria, the agricultural fecal coliform criterion has been omitted. Fecal coliform criteria for a raw water supply and for Class I (contact) and Class II (non-contact) recreation are 2000/100 ml, 200/100 ml, and 2000/100 ml, respectively. (See Appendix B for a more detailed discussion of public health.)

ODOR

The Odor Emission Regulation of Colorado prohibit emissions of odorous air contaminants from any single source such as to result in detectable odors which are measured in excess of the following limits:

- For areas used predominantly for residential or commercial purposes, it is a violation if odors are detected after the odorous air has been diluted with seven (7) or more volumes of odor free air.
- In all other land use areas, it is a violation if odors are detected after the odorous air has been diluted with fifteen (15) or more volumes of odor free air.

Odor concentrations eminating from wastewater treatment plants are directly related to the design and operating conditions. A properly operated treatment plant should not emit objectionable odors. Odor production generally occurs when the facility is overloaded or temporarily upset. An upset may be caused by a toxic chemical discharge or improper operation and management.

The sewage collection system is another potential source of odor problems. Long residence times in the sewer lines as a result of low flows and small grades can cause anaerobic conditions to develop. Such conditions can generate hydrogen sulfide and can be very troublesome when the odors are released to the atmosphere at open discharges.

Odor monitoring of the Lone Tree Creek treatment plant is being done by the Weld County Health Department. This anaerobic lagoon, industrial wastewater treatment facility is monitored four times annually and when complaints are made. During the period from 1974-1975, several odor violations were filed against the City of Greeley for odor concentrations exceeding the State regulations of 15 to 1 dilutions. The last off-site odors from the Lone Tree facility were reported on June 15, 1978. Since that time, the County Health Department has not detected any off-site odors. Improved operation of the facility appears to be responsible for the lack of monitored odor problems.

Other potential odor sources east of Greeley are the Webster Feedlot and Farr Feeders. It is reported that following rainstorms, these facilities emit ammonia odors (36). Conditions at the end of last summer were particularly bad. However, the new Colorado Air Quality Control Act (37) exempts feedlots from the odor regulations.

Climatological data for wind in the Greeley area indicate that areas to the north and west of an odor source would be impacted the most frequent. This is determined by the percentage of time the wind flows from any given 30 degree compass point (see Exhibit 4). Worst case odor analysis for the First Avenue treatment plant is shown in Exhibit 5.

Odor analysis typically consists of collecting a sample of air from the odor source, diluting it with pure non-odorous air to the desired concentrations (7 and 15 dilutions for Colorado Odor Regulations) and determine if the diluted odor can be detected by 50% of a randomly chosen group of people (panel). If more than 50% of the panel detects the odor following a dilution of seven times, the source is in violation for a residential/commercial area. If more than 50% of the panel detects the odor following a 15 times dilution, the source is in violation for all other land uses (industrial, etc.). The areas designated "7 dilutions" and "15 dilutions" on Exhibit 5 have been calculated based on climatological data for the Greeley area. The areas within the respective circles represent potential impact areas that could be affected by odors generated from the plant site even though the odors from the plant are within the Colorado State Odor Standards as described above.

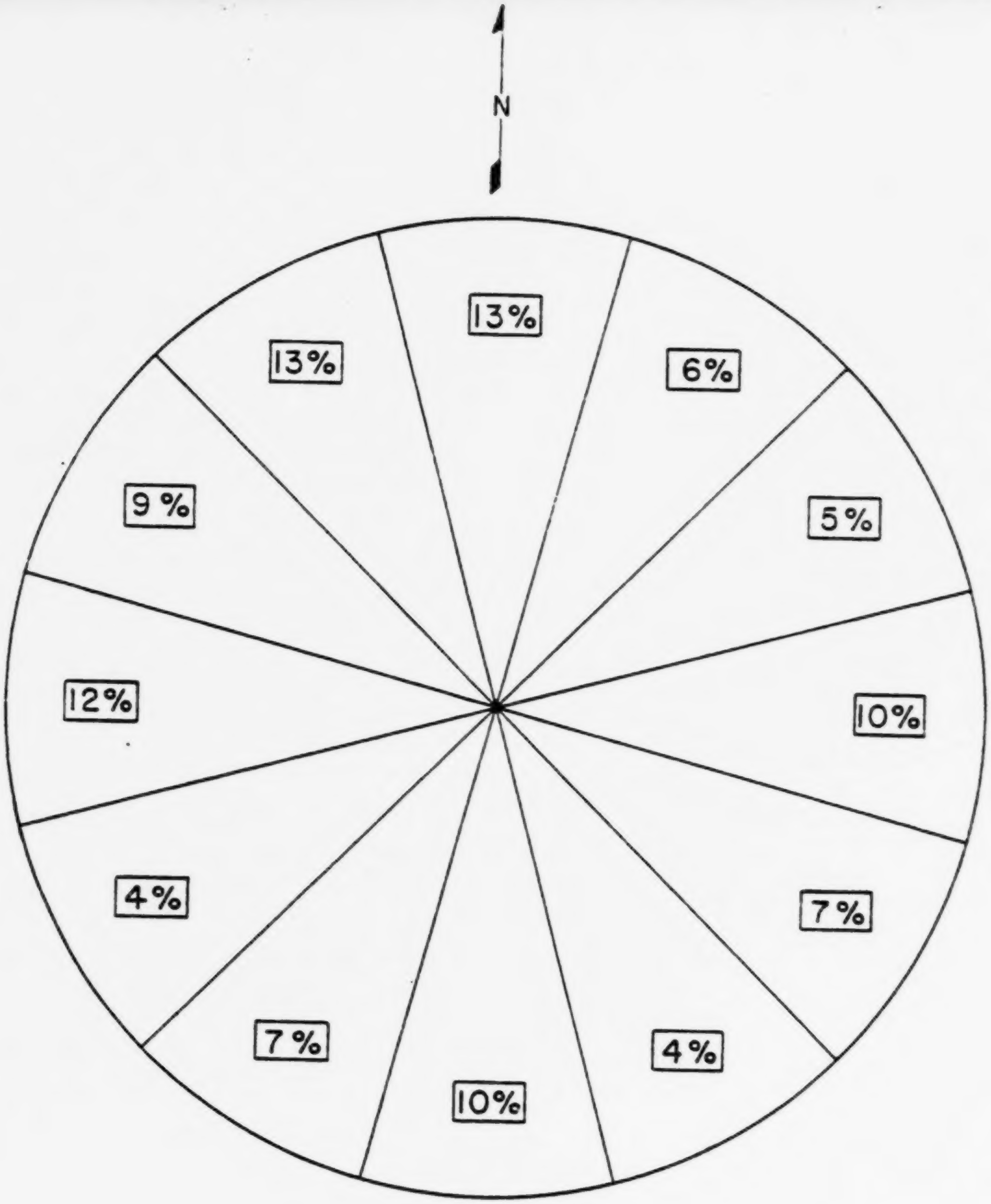
Existing Facilities

This section describes the existing wastewater treatment facilities in the Greeley Study Area. This includes the Greeley First Avenue and Lone Tree treatment plants as well as the Evans and Hill 'n Park plants. The locations of these facilities are indicated in Exhibit 6. A brief description of each facility follows with a more detailed analysis contained in Appendix C. Some of this information has been taken from the final environmental impact statement originally prepared for the proposed Greeley project.

First Avenue Plant (City of Greeley)

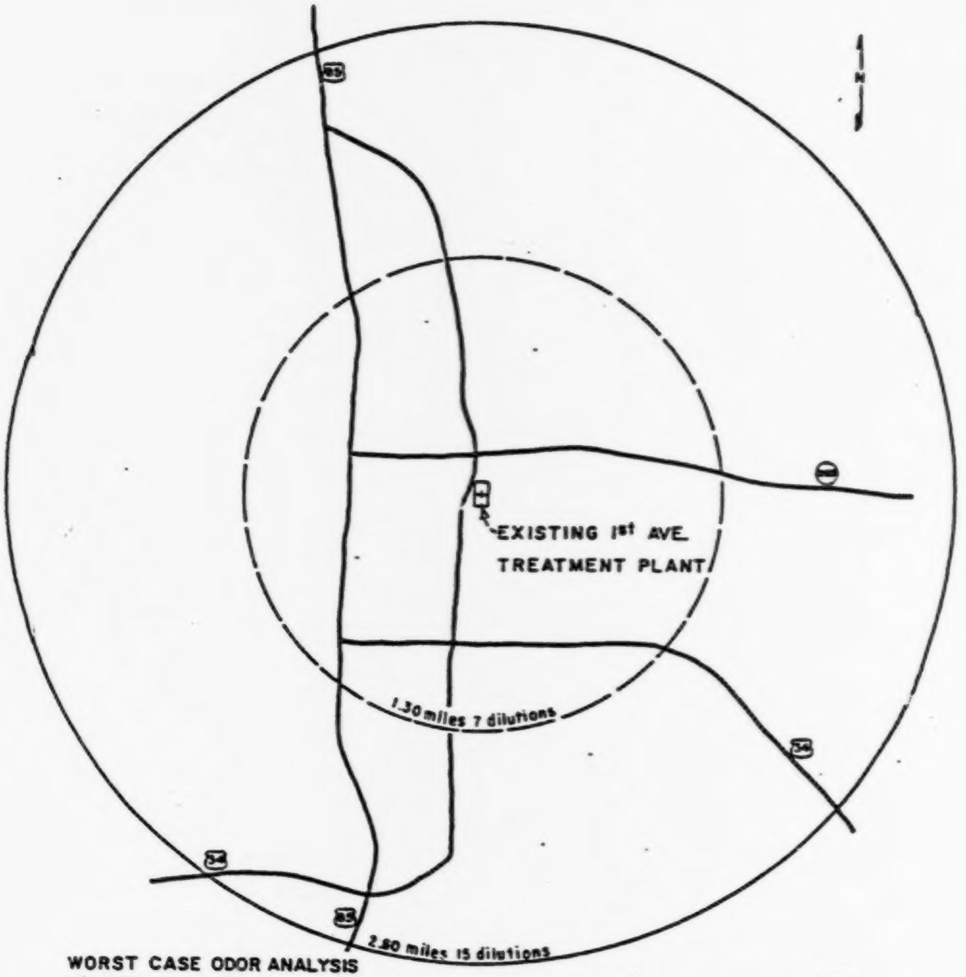
Treatment Facilities

The First Avenue plant consists of an older South Side trickling filter plant and a newer (1964) North Side activated sludge plant. The South Side facilities have a two million gallon per day nominal operation



PERCENTAGE OF TIME THE WIND BLOWS FROM EACH 30° SECTOR – GREELEY, COLORADO

EXHIBIT 4


85
N
EXISTING 1st AVE. TREATMENT PLANT
1.30 miles 7 dilutions
34
34
85
2.80 miles 15 dilutions
0
1 MILE
SCALE

WORST CASE ODOR ANALYSIS
1st AVENUE TREATMENT PLANT
(Using Class F wind stability - wind speed 3 to 7 mph)

LEGEND

- ——— Estimated area exceeding 15 dilutions
- — — Estimated area exceeding 7 dilutions

EXHIBIT 5

capacity and is presently operated at 100% of capacity. The remaining daily flow, averaging from four to five million gallons per day, is treated by the North Side facilities. The North Side facilities have a nominal operation capacity of six million gallons per day.

The raw wastewater flows through a pretreatment unit for removal of large solids. The flow is split by pumping a portion (controlled at two million gallons per day) to the South Side facilities and the remainder flows to the North Side facilities. The South Side trickling filter plant consists of one primary clarifier, two trickling filters, one final clarifier, one chlorination basin, pumping and control building, and anaerobic sludge digesters. The North Side activated sludge facility consists of two primary clarifiers, two aeration basins, and two final clarifiers. Sludge from this plant is pumped to the Lone Tree Creek plant for treatment and disposal. The North Side effluent flows across to the South Side where it is mixed with the South Side effluent. The combined effluent is then chlorinated and discharged to the Cache la Poudre River.

The discharge from this plant has generally met discharge permit requirements of 30 milligrams per liter for both biochemical oxygen demand (BOD) and suspended solids, however, periodic violations have occurred.

Collection System

The Greeley sanitary sewer system includes 12,200 sewer lines, 207 miles of gravity sewers, eight miles of force main pressure sewers and nine lift stations (pump houses). The Greeley system also receives some flow from sewers outside the corporate units--Highland Hills, Farmers Truck Line Grove and the Spanish Colony Sanitation District. The sewers are constructed primarily of vitrified clay and the remainder are concrete sewers.

An infiltration/inflow (I/I) analysis was performed on the Greeley sewer system. The results showed that I/I averages 40 to 45 percent of the total flow in the service lines in the summer months and 18 to 21 percent in the winter months with the majority originating in the service lines themselves. It was also determined that up to three million gallons per day of I/I could be removed through a sewer system rehabilitation program and this approach was more cost-effective than constructing additional treatment capacity.

Industrial Discharges

The Monfort Meat Packing Plant is the largest industry in the City of Greeley. Removal of Monfort wastewater from the First Avenue Plant in 1973 substantially improved the operation of this facility. An industrial water survey (9) prepared by CH_2M-Hill identified six other potentially significant industries whose wastewater is treated at the First Avenue Plant. These industries are:

- Meadow Gold Dairy
- Misco Textile Rentals, Inc.
- Cassedy Brothers Meat Company
- HESCO Manufacturing, Inc.
- Sanitary Laundry and Cleaners, Inc.

Lone Tree Treatment Plant (East Lagoon)

This facility is a secondary biological facility utilizing anaerobic ponds for clarification and large aerobic ponds for effluent polishing. It essentially treats wastewater from the Monfort Packing Plant and waste activated sludge from the North Side Plant. Monfort has a contractual agreement dated March 7, 1970 with the City of Greeley for this wastewater treatment. The plant discharges to the Lone Tree Creek, one mile above its confluence with the South Platte River.

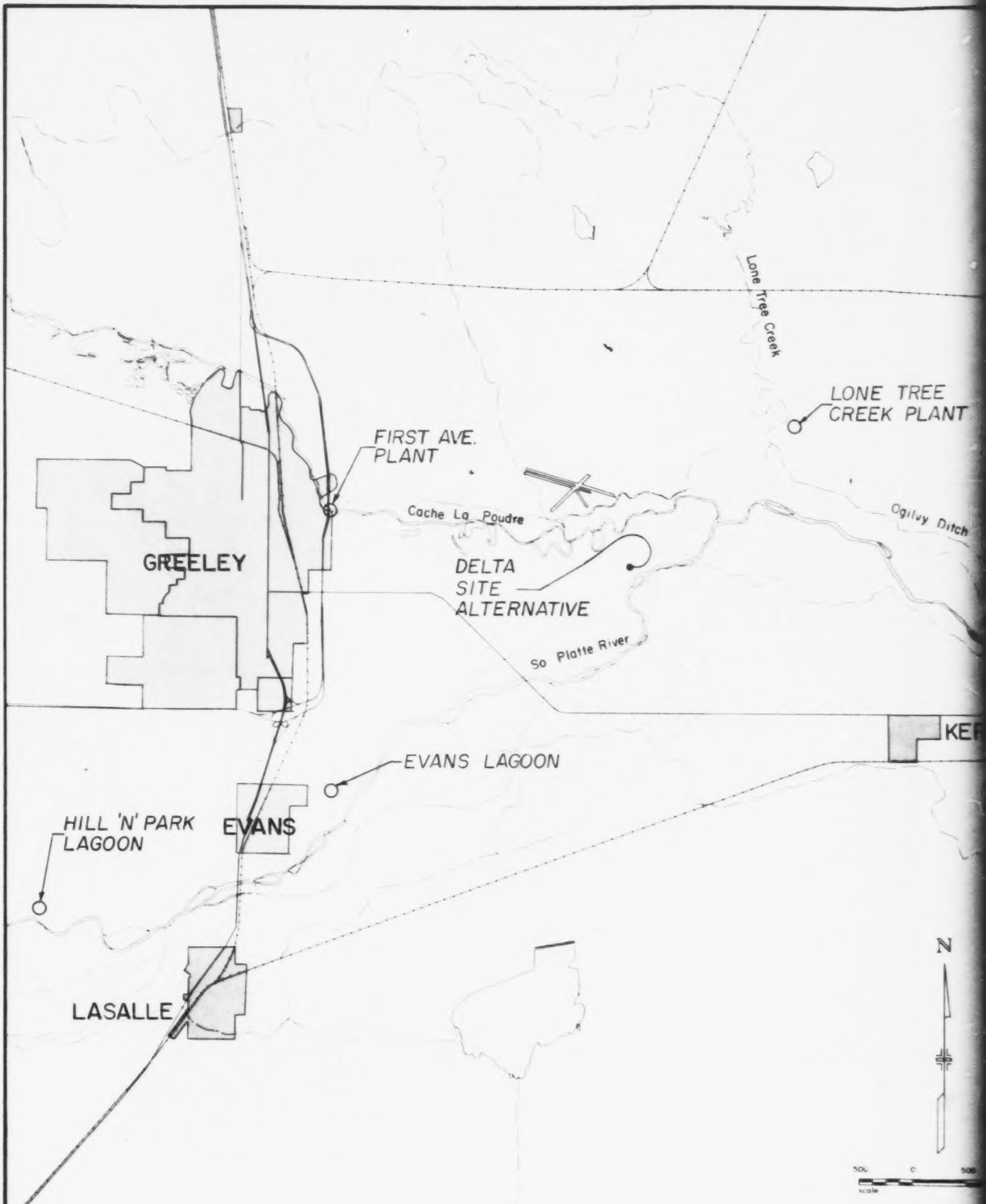
Evans Sanitation District Facilities

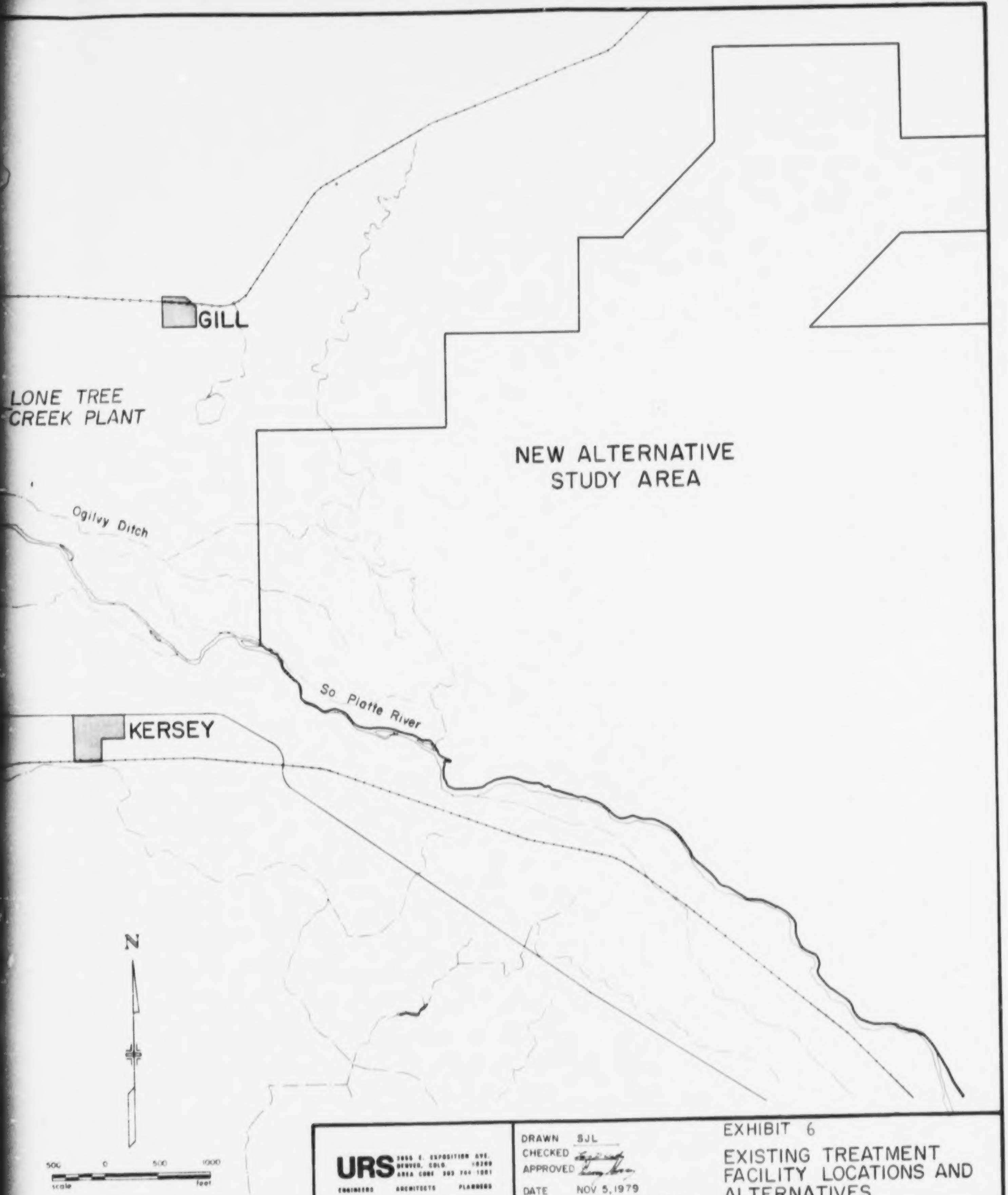
The Evans Sanitation District serves approximately 4500 people with collection and treatment facilities. The sewer system includes 925 service lines, and 13 miles of vitrified clay gravity sewers. There are no major problems with infiltration/inflow, therefore, no sewer system rehabilitation is required.

The treatment facilities consist of two aerated lagoons with a 30-day detention time and a treatment capacity of 0.6 million gallons per day. A third lagoon is planned which would expand the treatment capacity to 1.2 million gallons per day.

Hill 'n Park Sanitation District Facilities

The Hill 'n Park treatment facilities consist of two aerobic lagoons with a retention time of 52 days. These facilities presently serve approximately 1500 people.


Lone Tree Creek
LONE TREE CREEK PLANT
FIRST AVE. PLANT
Cache La Poudre
Ogilvy Ditch
GREELEY
DELTA SITE ALTERNATIVE
So Platte River
KER
EVANS LAGOON
HILL 'N' PARK LAGOON
EVANS
LASALLE
N
500
0
500
scale


GILL
LONE TREE CREEK PLANT
NEW ALTERNATIVE STUDY AREA
Ogilvy Ditch
So Platte River
KERSEY
N
500 0 500 1000
scale
feet

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DRAWN SJL
CHECKED
APPROVED
DATE NOV 5, 1979
URS PROJECT NO. 9109

EXHIBIT 6

EXISTING TREATMENT FACILITY LOCATIONS AND ALTERNATIVES

DELTA MECHANICAL PLANT

The Delta mechanical plant facility was the recommended alternative in the original EIS. Due to the cost overruns and public opposition to the project, other treatment plant alternatives are being considered. However, the mechanical system at the Delta site is still a possible technical alternative. (See Exhibit 7).

This alternative would consist of a new 12 million gallon per day (MGD) facility located in the original Delta site. The site location is east of Greeley near the confluence of the Cache la Poudre and South Platte rivers. In addition to the new facility, the existing First Avenue plant would have both its north side operation and south side operation deactivated while being used as a potential pumping station. In the original facility plan, the north side facility would have remained in operation until the mid 1990's. When the First Avenue facility was completely phased out, an additional six MGD module would have been built at the Delta site bringing the total treatment capacity to 12 MGD. However, further analysis has established this phasing approach to be not cost-effective. Therefore, phasing will no longer be considered.

The Delta mechanical plant alternative has four basic components. They are:

- Outfall from First Avenue to site
- Extension of Southeast Interceptor
- The physical plant
- Discharge to river

The discharge (raw sewage) from the modified First Avenue plant to the proposed Delta plant would be a gravity transmission line. All wastewater would be transmitted to the new facility for treatment. The southeast interceptor line would be extended to collect wastewater in the southern sections of the city. Eventually, the line could be extended to the Evans and Hill 'n Park Lagoons. It would then be possible to treat all of the city's residential wastewater at one location.

The plant itself would be constructed as a 12 MGD facility in one phase. Some of the components of the mechanical plant include primary settling, aeration basins, secondary settling, chlorination, and sludge thickening and digestion.

At the time of discharge from the Delta plant, the wastewater will have undergone secondary treatment. The First Avenue plant discharged treated effluent above the intake of the Ogilvy Ditch. The Delta alternative will discharge at the Delta location thus bypassing the intake to the Ogilvy Ditch.

Table 9 presents the project cost summary for the Delta mechanical facility alternative. All costs are in 1979 dollars for project life.

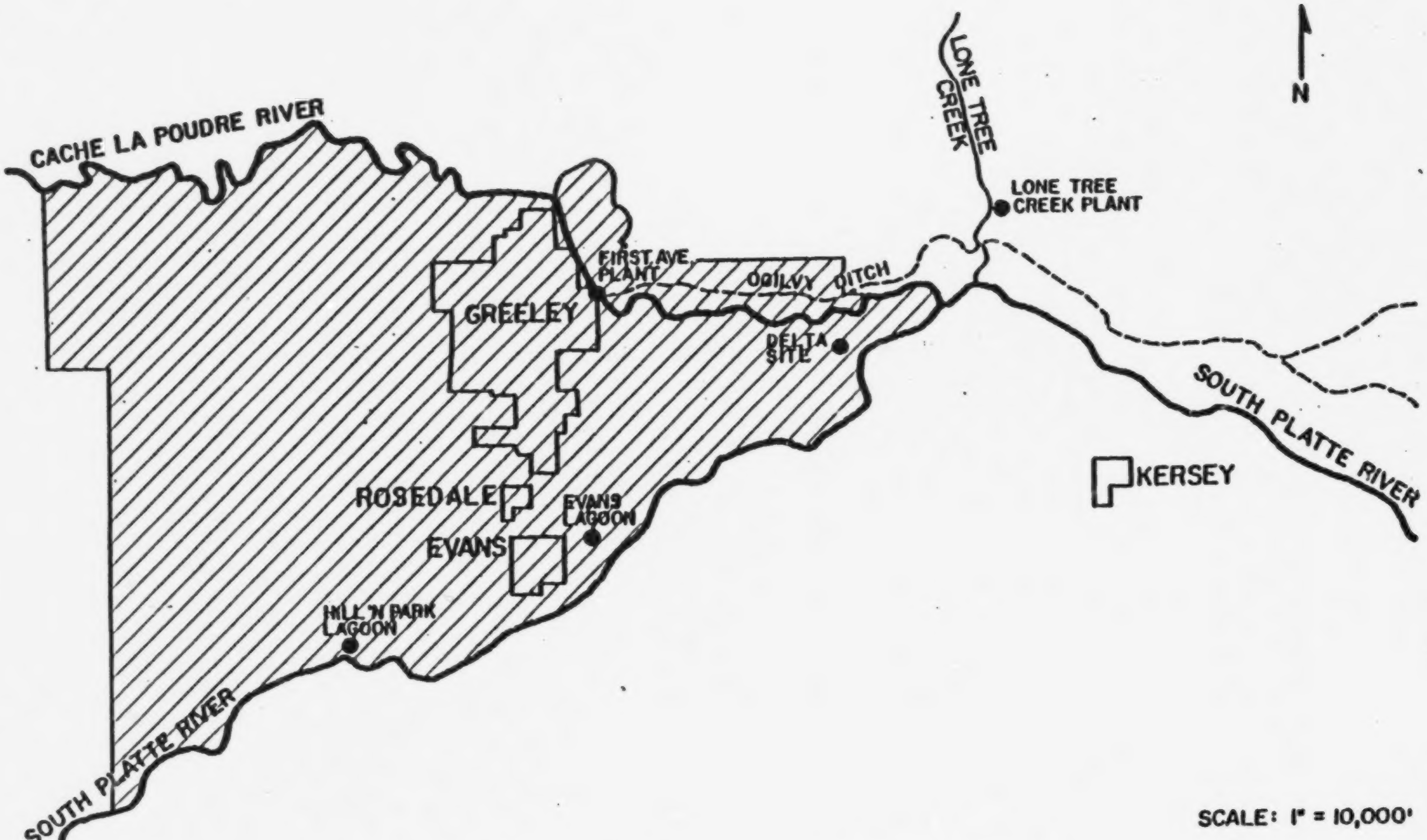

N
CACHE LA POUDRE RIVER
LONE TREE CREEK
LONE TREE CREEK PLANT
FIRST AVE PLANT
OGILVY DITCH
GREELEY
DELTA SITE
SOUTH PLATTE RIVER
KERSEY
ROSEDALE
EVANS LAGOON
EVANS
HILL 'N PARK LAGOON
SOUTH PLATTE RIVER
SCALE: 1" = 10,000'

Exhibit 7
Original Study Area with Delta alternative

Source: Final EIS Greeley Region Wastewater Management Program 1976

TABLE 9

Project Cost Summary - Delta Plant (Million Dollars)

	High	Low
Capital Cost Total Cost	24.7	23.8
Local Share Capital Cost	6.2	6.0
Operation and Maintenance	6.4	6.0
Equivalent Annual Cost Total EAC	2.9	2.8
Local Share EAC	1.176	1.119
Present Worth	31.1	29.8

Source: ARIX Corporation

For a detailed description of costs, see the Arix facilities plan, Wastewater Facilities Planning, Report #1 Evaluation of Alternatives for Greeley, Colorado, Volume II, Appendix E Capital Cost Estimates.

TREATMENT AND DISCHARGE TO CROW CREEK

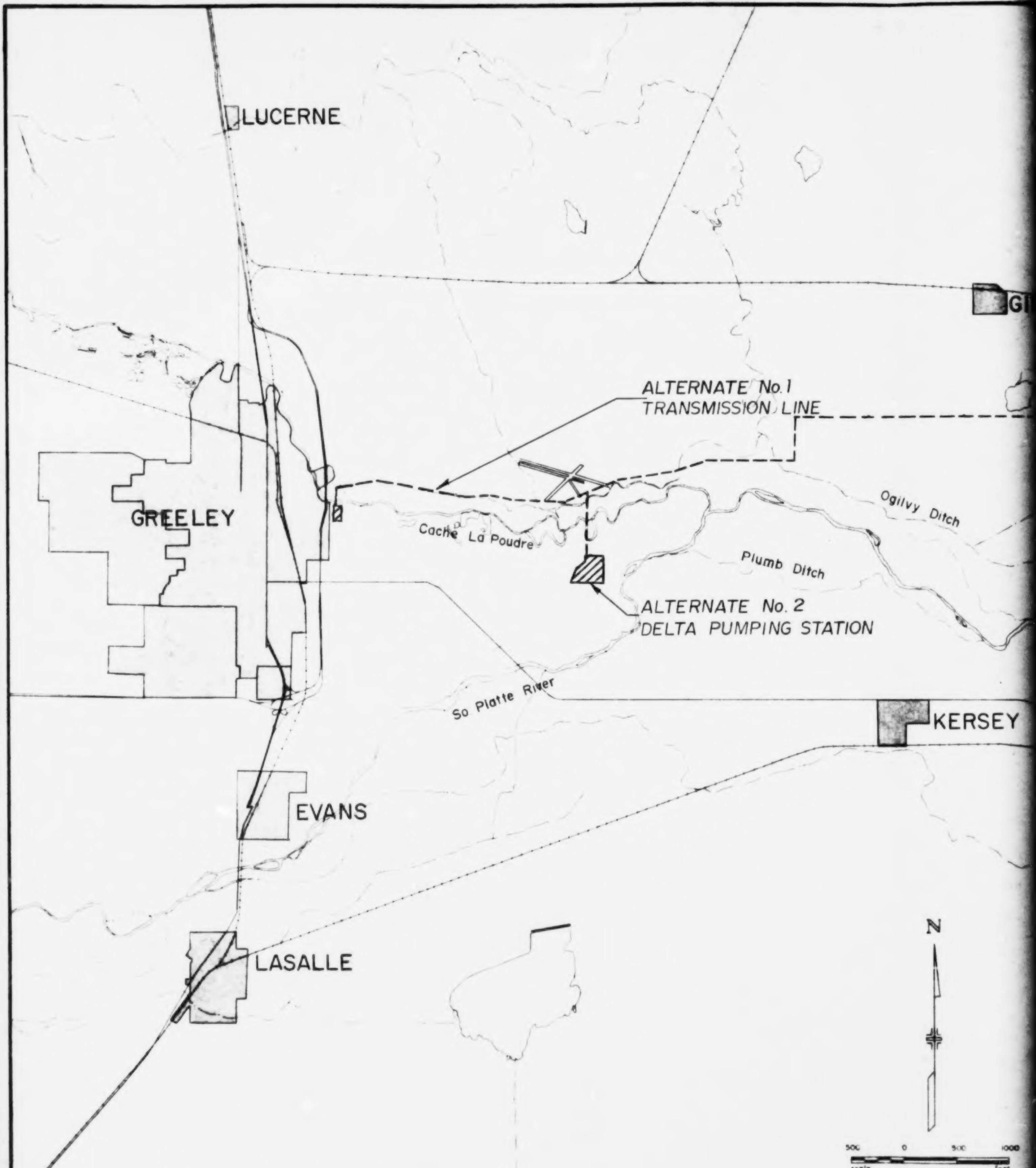
Under this alternative, outfall lines, pumping stations, transmission lines and an aerated treatment lagoon will all be incorporated into the system. Basically, the sewage would be pumped from a station at either the First Avenue or Delta site to an aerated lagoon located approximately three miles east of Gill. Following treatment to an acceptable level, the treated wastewater will either be discharged directly into Crow Creek or stored for a period and then discharged. The five primary components to this alternative are:

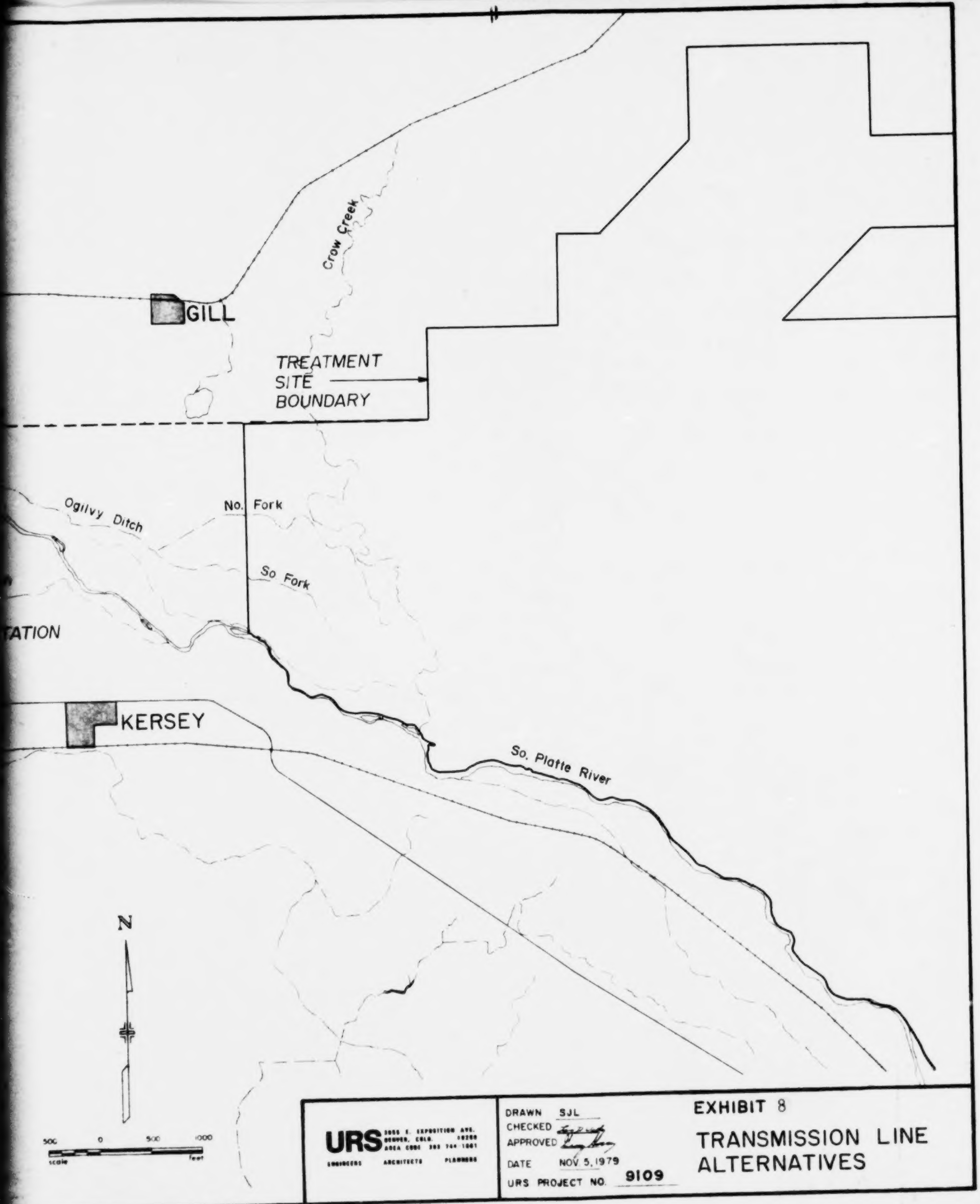
- Outfall lines to common location
- Preliminary treatment and pumping
- Transmission line
- Treatment facility
- Discharge line to Crow Creek

The first stage of this system, the outfall lines, are the major sewer lines that will extend from the city to one of the following two proposed pumping stations; the First Avenue pumping station or, the Delta pumping station. The First Avenue station would be located in the northeast sector of Greeley at the existing First Avenue plant site. The majority of sewage pumped through this station would come from the existing West Line. The other alternative, the Delta station, would be located farther east and just south of the municipal airport. Sewage pumped through this station would come both from the North Gravity Line and the South Line. The latter would require additional pumping to reach the Delta station.

The preliminary treatment that would occur at either of these stations will entail the removal of any large solids possibly followed bv grit removal. The size of the lines will determine whether grit removal is required. More specifically, if twin 30 inch lines are constructed, then the grit can be transported to the lagoon sites. Whereas, a single 36-inch line will require grit removal at the filter station.

The path that either the dual 30-inch line or the single 36-inch will follow is described in Exhibit 8. Alternative 1 represents the proposed First Avenue transmission line that would run from the First Avenue pumping station to the treatment site boundary. This line is almost eleven miles long and it follows the 8th Street alignment to the airport. Then it gradually swings north and east along the section line south of Briscoe Lake. Alternative 2 shows transmission from the proposed Delta site. This alignment is identical to the First Avenue line except for a short section running south to the Delta pumping station. Again, in either of these systems a single 36-inch line or dual 30-inch line can be employed. Project cost summary is found on Page 31.


LUCERNE
GI
ALTERNATE No.1
TRANSMISSION LINE
GREELEY
Cache La Poudre
Ogilvy Ditch
Plumb Ditch
ALTERNATE No. 2
DELTA PUMPING STATION
So Platte River
KERSEY
EVANS
LASALLE
N
500
0
500
1000
scale
feet


Crow Creek
GILL
TREATMENT SITE BOUNDARY
Ogilvy Ditch
No. Fork
So Fork
TATION
KERSEY
So. Platte River
N
500
0
500
1000
scale
feet

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APPROVED
DATE NOV. 5, 1979
URS PROJECT NO. 9109

EXHIBIT 8

TRANSMISSION LINE ALTERNATIVES

9

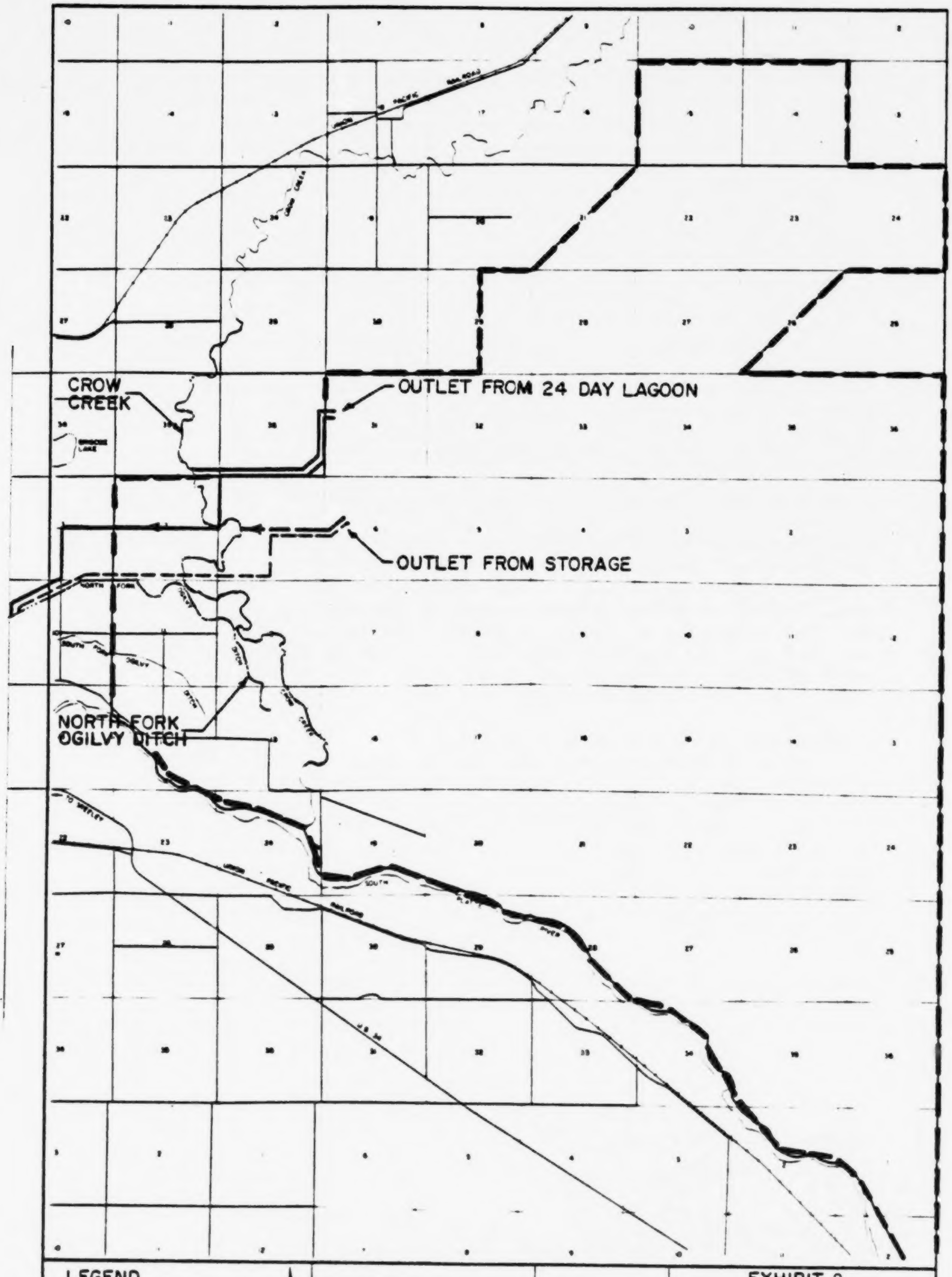
These lines will feed into one of two possible treatment facilities; a 24-day Aerated Lagoon or a 4-day Aerated Lagoon. The 24-day lagoon generally consists of two or more earthen basins with a combined capacity equal to the total average flow of wastewater for approximately 24 to 30 days. The liquid within the basin is mechanically aerated with either floating aerators or by the dispersion of compressed air through sub-surface distributors. The organic portion of the solids decomposes through aerobic and anaerobic processes. The volume of the stabilized sludge at the bottom of the lagoon accumulates at a very slow rate (up to twenty years). Sludge would be disposed of through land application as fertilizer.

The storage cells in the 4-day lagoon system are much smaller and provide for a total detention time of approximately four days instead of the 24-day period. This reduction in size increases the amount of aeration needed, and requires accumulated sludge removal approximately every three years. Construction costs are slightly less for this lagoon than for the 24-day lagoon ($4,443,000 and $4,509,000 respectively). However, a storage reservoir would be required under this alternative, as an intregal part of the treatment process.

Once the sewage has been treated to an acceptable level, the treated wastewater will be either discharged immediately into Crow Creek or retained in storage ponds and then released into the Creek at a later date. Under the direct discharge option, the water would be chlorinated and discharged straight into Crow Creek. During periods when suspended solids exceed the maximum allowable amounts in the discharge permit, the water would be filtered through micro-strainers prior to discharge. The routing of this discharge line is presented in Exhibit 9.

A major benefit of the storage option is that it will provide a reserve capacity or back-up insurance for any reservoirs further downstream. If a call is made on the river, the city would be in a better position to comply with that request with reservoir capabilities. This would serve to provide water to the South Platte that has been adequately treated. Several potential sites for storage reservoirs were initially identified and based on a preliminary analysis of construction costs, volume requirements, and proximity to the most desirable application areas (if the land application system is to be employed), the reservoir should be located within Section 31 as shown in Exhibit 10.

The topography of this area is well suited for economical construction of the reservoir at the required capacity.


UNION PACIFIC RAILROAD
CROW CREEK
CROW CREEK
OUTLET FROM 24 DAY LAGOON
OUTLET FROM STORAGE
NORTH FORK OGILVY DITCH
NORTH FORK
SOUTH FORK OGILVY DITCH
NORTH FORK OGILVY DITCH
TO GREELEY
UNION PACIFIC RAILROAD
SOUTH PLATTE RIVER
U.S. 34

LEGEND

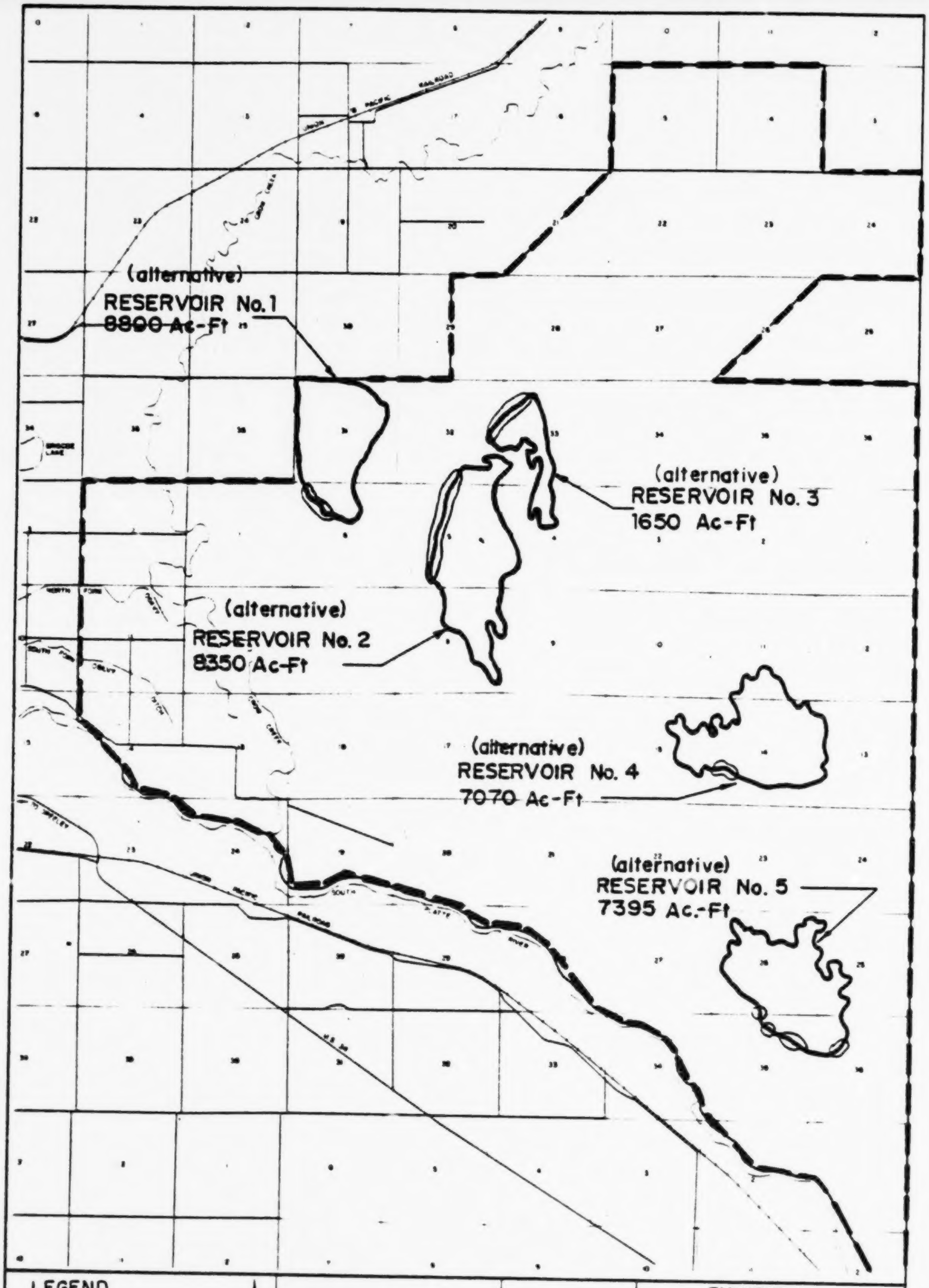
▬ ▬ Study Area Boundary

URS [illegible] E. EXPOSITION AVE.
DENVER, COLO. [illegible]
AREA CODE 303 [illegible]
ENGINEERS ARCHITECTS PLANNERS

MAP TAKEN FROM
GREELEY 201 STUDY
BY ARIX CORP

EXHIBIT 9

DISCHARGE LINES TO CROW CREEK AND OGILVY DITCH


(alternative)
RESERVOIR No. 1
8800 Ac-Ft
(alternative)
RESERVOIR No. 3
1650 Ac-Ft
(alternative)
RESERVOIR No. 2
8350 Ac-Ft
(alternative)
RESERVOIR No. 4
7070 Ac-Ft
(alternative)
RESERVOIR No. 5
7395 Ac.-Ft
Union Pacific Railroad
South Platte River
U.S. 34

LEGEND

▬ ▬ Study Area Boundary

URS 3955 E. Exposition Ave. Denver, Colo. 80209 Area Code 303 744-1861

ENGINEERS ARCHITECTS PLANNERS

MAP TAKEN FROM
GREELEY 201 STUDY
BY ARIX CORP

EXHIBIT 10

RESERVOIR SITES

TREATMENT AND DISCHARGE TO OGILVY AND CROW CREEK

This system is indistinguishable from the Treatment and Discharge to Crow Creek system except that here there is also a discharge line into the North Fork of the Ogilvy Ditch. The exact route that this line would take is shown in Exhibit 8. The rest of the system, including outfall lines to the First Avenue and Delta pumping stations, the preliminary treatment and pumping, the treatment facilities, and the outfall line to Crow Creek are identical to the previous system.

The following table summarizes project costs under the Crow Creek and the Ogilvy alternates. For a detailed description of costs, see the ARIX Facilities Plan, Wastewater Facilities Planning, Report #1, Evaluation of Alternatives for Greeley, Colorado, Volume II Appendix E Capital Cost Estimates. All costs are in 1979 dollars for project life.

TABLE 10

Project Cost Summary (Million Dollars)

	Crow Creek		Ogilvy	
	High	Low	High	Low
Capital Cost Total Cost	31.1	21.8	32.8	22.9
Local Share Capital Costs	7.8	5.5	8.2	5.7
Operation and Maintenance	6.8	5.7	6.9	5.7
Equivalent Annual Cost Total EAC	3.5	2.6	3.7	2.7
Local Share EAC	1.331	1.092	1.337	1.125
Present Worth	37.6	28.1	39.3	29.4

Source: ARIX Corporation

LAND APPLICATION SYSTEM

The final alternative is the land application system. This system utilizes treated effluent for irrigation purposes. The seven primary components are:

- Outfall line to common location
- Preliminary treatment and pumping
- Transmission lines
- Pretreatment
- Storage
- Distribution system
- Discharge recovery

The outfall line to a common location would be the same type of an arrangement as is the case with the Crow Creek and Crow Creek-Ogilvy alternatives. One or more of three alternate routings would be followed; North Gravity Line to Delta Site, South Line with pumping to Delta Site and/or West Line with pumping to First Avenue.

Preliminary treatment and pumping as well as transmission are also the same as the previous two alternatives. The transmission lines affect the pumping and preliminary treatment requirements. If one 36-inch line is used, pretreatment will consist of screening for removal of large solids and settling for grit removal. If the 30-inch line is used, grit removal would not be necessary because water pressure would be adequate to carry the grit to the treatment lagoons in the study area. The 30-inch line could either be a single or dual pipeline. If only a single line, plans would call for adding an additional 30-inch pipe in a right-of-way reserved when the first line was laid.

The pretreatment stage will consist of either the four-day lagoon or the 24-day lagoon (See Exhibits 11 and 12). Sludge, when disposal becomes necessary, would be used as fertilizer for the crops to be grown in conjunction with this alternative. Unlike the Crow Creek alternative, both lagoons will bring water quality up to a level acceptable for the next stage in the process. Whereas the previous two alternatives discharged the effluent after treatment in the lagoons (or via a storage reservoir), the land application alternative further treats the wastewater.

After treatment in the lagoons, the effluent is discharged to a storage reservoir (see Exhibit 10). The potential sizes of the reservoirs would be from 1650 acre feet to 8800 acre feet. These sizes represent the maximum acre feet at the location due to topographical considerations. Wastewater at this stage would be treated at a secondary level. Originally, three methods of irrigation were considered, 1) ridge and furrow, 2) surface flooding, and 3) sprinkler irrigation. Ridge and furrow irrigation does not adapt well to the study area due to the high permeability of the study area soils. This would cause the water to concentrate in the upper ends of the furrows leaving higher salt concentration in the lower ends. Yields would also suffer because salts tend to concentrate around the crops.

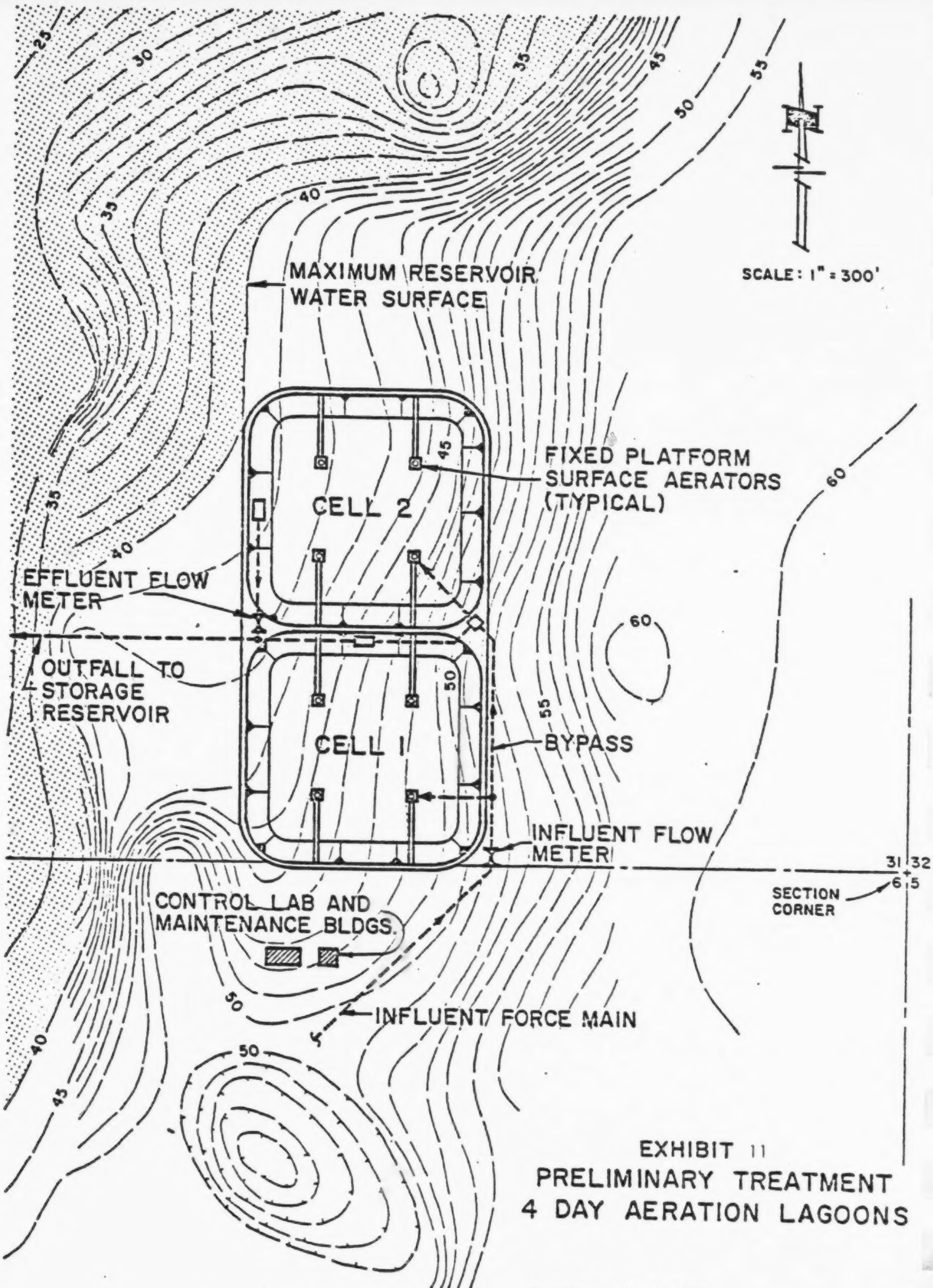

25
30
35
45
50
55
40
35
MAXIMUM RESERVOIR WATER SURFACE
SCALE: 1" = 300'
35
40
45
FIXED PLATFORM SURFACE AERATORS (TYPICAL)
60
CELL 2
EFFLUENT FLOW METER
60
OUTFALL TO STORAGE RESERVOIR
50
55
CELL 1
BYPASS
INFLUENT FLOW METER
31 32
6 5
SECTION CORNER
CONTROL LAB AND MAINTENANCE BLDGS.
50
INFLUENT FORCE MAIN
50
40
45

EXHIBIT 11

PRELIMINARY TREATMENT
4 DAY AERATION LAGOONS

Source: ARIX Corp.

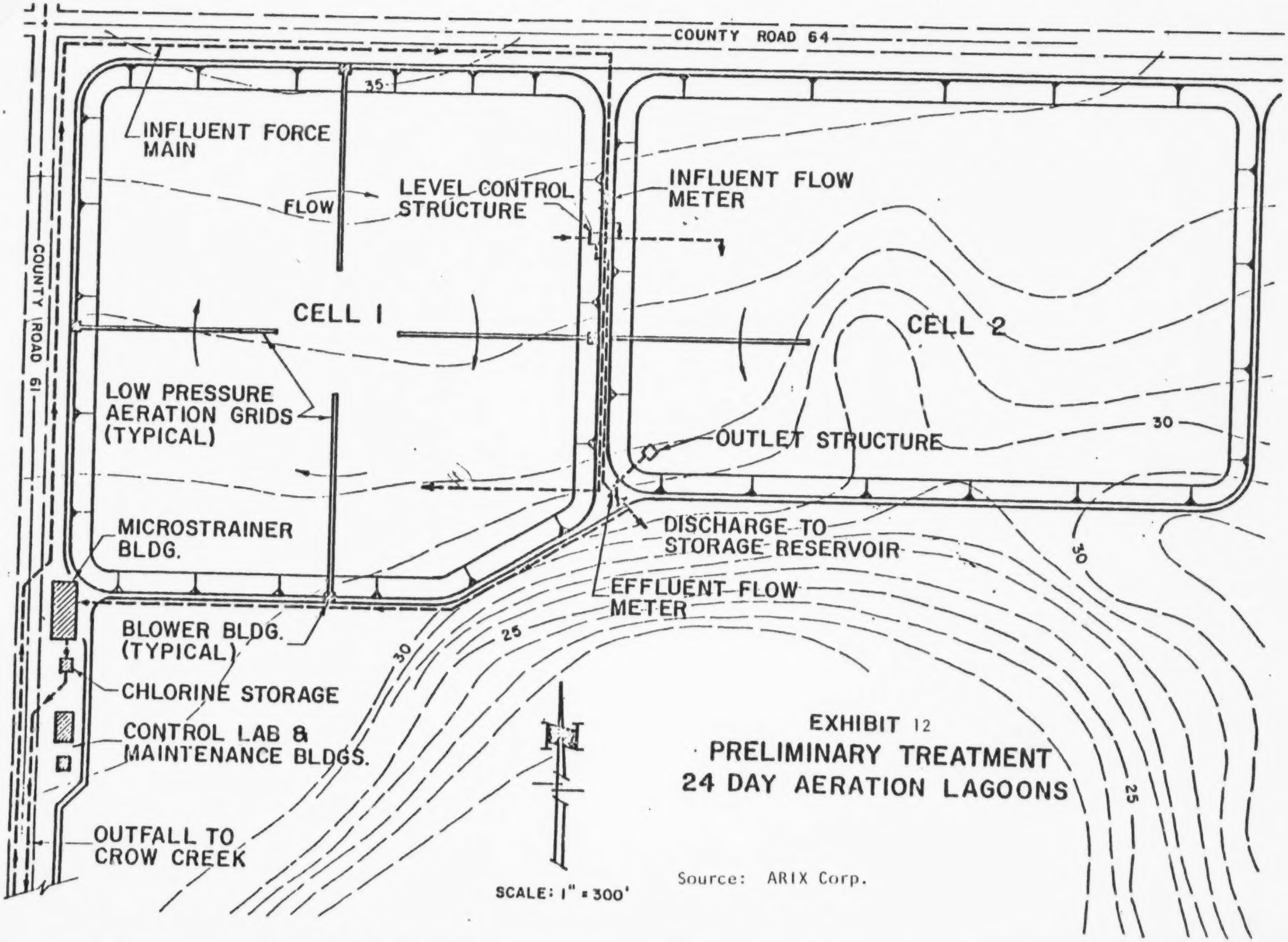

COUNTY ROAD 64
COUNTY ROAD 61
35
INFLUENT FORCE MAIN
FLOW
LEVEL CONTROL STRUCTURE
INFLUENT FLOW METER
CELL 1
CELL 2
LOW PRESSURE AERATION GRIDS (TYPICAL)
OUTLET STRUCTURE
30
MICROSTRAINER BLDG.
DISCHARGE TO STORAGE RESERVOIR
30
EFFLUENT FLOW METER
BLOWER BLDG. (TYPICAL)
25
30
CHLORINE STORAGE
CONTROL LAB & MAINTENANCE BLDGS.
25
OUTFALL TO CROW CREEK
SCALE: 1" = 300'

EXHIBIT 12

PRELIMINARY TREATMENT
24 DAY AERATION LAGOONS

Source: ARIX Corp.

Because the topography of the study area is not uniform (varying slopes, sandy soils, etc.), surface flooding would not be a feasible alternative. The key element in this method is uniform water distribution. This cannot be achieved in the study area. Labor requirements would also be extensive, offsetting the production value of crops grown.

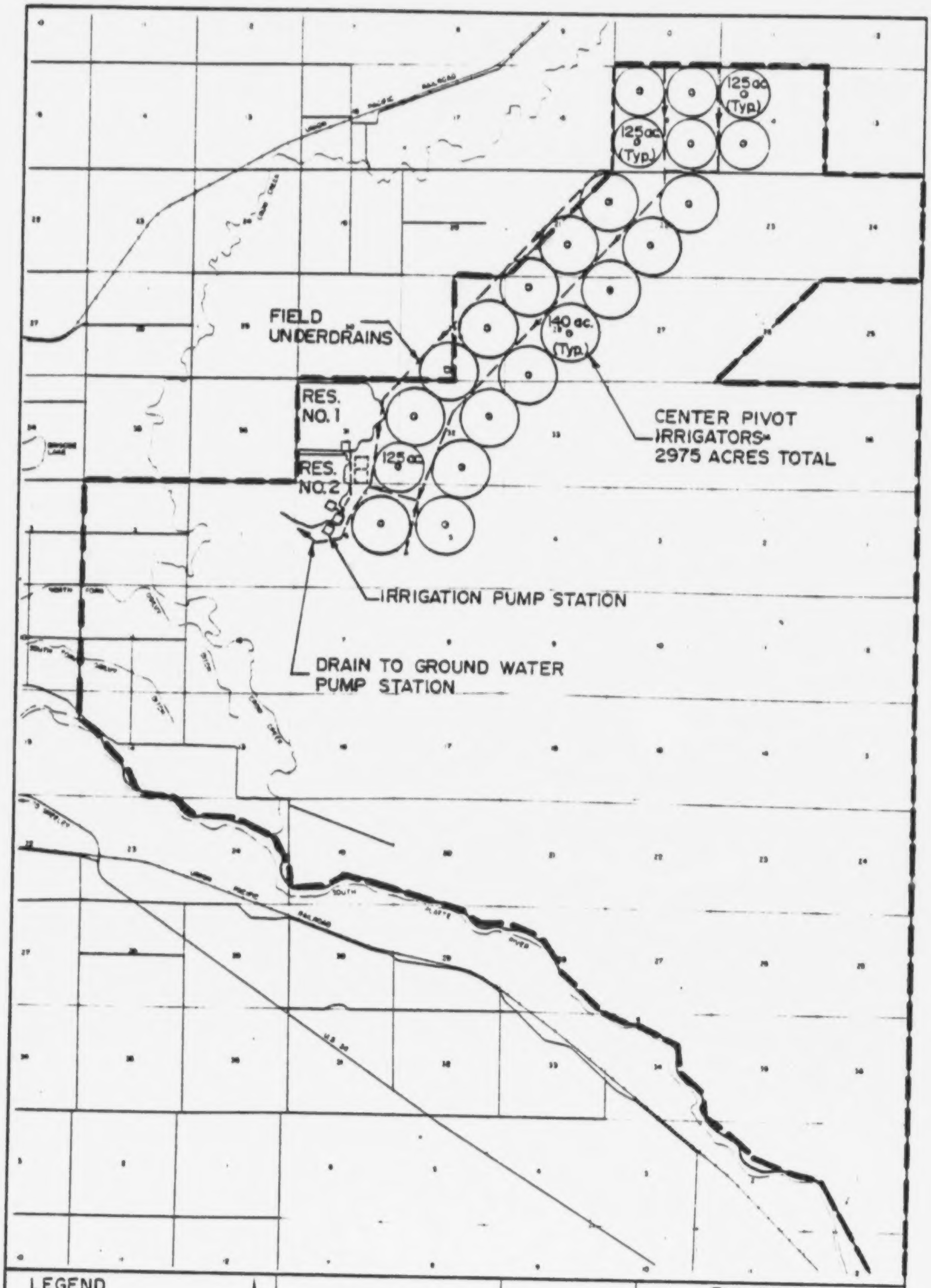
The final method, sprinkler irrigation, is well suited to the study area because the sprinkler system can negotiate the varying slopes. The type of system that would be utilized would be a center pivot sprinkler irrigation system.

These sprinklers would have low head nozzles designed to spray the effluent down to the crops rather than traditional nozzles that spray higher in the air off of the sprinkler line. Spraying down would reduce effluent aerosol dispersal decreasing the chance of contact between humans and effluent. In addition, the spray bar is adjusted according to the height of the crop growth to maintain as low a height as is possible. The ARIX 201 feasibility study described the center pivot sprinkler as consisting of:

> a single sprinkler lateral which moves in a circle about a fixed pivot structure. Water is supplied to the lateral at the pivot. The lateral is supported by towers which are kept in line by an alignment system which automatically shuts down the sprinkler before the lateral can be damaged by being out of line. The lateral is usually moved by hydraulic water or electric motor drives mounted on each support structure. Slope differentials of up to 30 percent can be negotiated. (See Exhibit 13).

Once applied, the effluent percolates through the soil for further treatment. The soil in the study area is very sandy and porous allowing for good permeability. This acts as a filtering agent. With proper application rates, the nitrogen is absorbed by the crops to prevent overloading of the soil. As the water enters the root zone, it is directed by bedrock and underground collectors to a drainage ditch for discharge into either Crow Creek or back into the reservoir. The collector drains also serve to prevent flooding of the root zone. Once in the drainage ditch, the water can be analyzed for quality. At point of discharge, the effluent is treated to a tertiary level.

Table 11 presents the project cost summary for the land application system alternative. All costs are in 1979 dollars for project life.



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FIELD UNDERDRAINS
RES. NO. 1
RES. NO. 2
CENTER PIVOT IRRIGATORS- 2975 ACRES TOTAL
IRRIGATION PUMP STATION
DRAIN TO GROUND WATER PUMP STATION
UNION PACIFIC RAILROAD
SOUTH PLATTE RIVER
U.S. 34

LEGEND

▬ ▬ Study Area Boundary

URS [illegible]

ENGINEERS ARCHITECTS PLANNERS

MAP TAKEN FROM
GREELEY 201 STUDY
BY ARIX CORP

EXHIBIT 13

CENTER PIVOT SPRINKLER IRRIGATION SYSTEM

TABLE 11

Project Cost Summary - Land Application System (Million Dollars)

	High	Low
Capital Cost Total Cost	37.3	32.0
Local Share Capital Cost	9.3	8.0
Operation and Maintenance	.485	.632
Equivalent Annual Cost Total EAC	3.4	3.0
Local S		
Local Share EAC	.884	.717
Present Worth	37.4	31.8

Source: ARIX Corporation

For a detailed description of costs, see the Arix Facilities Plan, Wastewater Facilities Planning, Report #1 Evaluation of Alternatives for Greeley, Colorado, Volume II, Appendix E Capital Cost Estimates.

ENVIRONMENTAL CONSEQUENCES

Introduction

Probably the greatest concern regarding the development of a new wastewater treatment facility would be the creation of significant growth related secondary impacts. This is allied primarily to the assumption that additional sewage treatment capacity will stimulate or induce population growth. However, rapid growth has been experienced in the Greeley area for some time now, through the late 60's and most of the 70's, and has been moving primarily in a westward direction from the city. This has resulted in some of the agricultural land in the west being replaced by residential development and some associated commercial uses.

The resident population of the City of Greeley alone is expected to increase from 60,000 in 1979 to close to 113,000 by the year 2000. This will likely result in considerable changes and expansion of the existing employment characteristics, tax base, education and recreation facilities, and commercial, industrial and residential land use patterns. To keep up with these growth patterns, additional sewage treatment facilities will be essential. Thus, it would seem that a "no action" alternative is not realistic.

The proposed location of the new facilities on the east side of town will not stimulate any residential growth in the immediate area. Adverse effects associated with sewage treatment, such as odor and sludge wastes, will probably have some negative influences on the type of uses that will locate near the facilities. Land in this area may be more favorable for certain industrial or business uses. This would then continue to support further residential growth on the west side of the city.

At present, there is a system of land use regulations and policies controlling the use of land in a 60-square mile study area around Greeley. Weld County has jurisdiction over approximately 85 percent of the study area with Greeley and the adjacent communities of Evans, Garden City and Rosedale, having control over the remaining urbanized portions. Since the adoption of these controls in 1973, there has been a general policy in effect that new growth is contained around cores of existing urban development.

These land use controls and policy are based on an adopted comprehensive plan, zoning regulations, the uniform building code and subdivision regulations (Senate Bill 35). A list of policy statements used by the county in achieving the basic pattern of ring growth around existing towns was summarized in the original EIS.

The cultural resources inventory report identified nine prehistoric finds, five prehistoric sites, five prehistoric localities, one historic find and one historic isolated find. None of these resources are eligible for the National Register of Historic Places. Therefore, based on the pedestrian survey and evaluation of resources contained in the sample tracts, no significant impact to cultural resources would occur as a result of cultivation/irrigation system construction. For a more detailed discussion of the cultural resource inventory report, see Cultural Resource Inventory Report, Greeley Wastewater Facilities Project, Weld County, Colorado (Gordon and Kranzush, Inc. #79-16, 9/11/79); and Wastewater Facilities Planning, Report #1, Evaluation of Alternatives for Greeley, Colorado (Arix, Volume 1, 8/79).

Alternative Impacts

The four alternatives identify nine differenct treatment processes for treating Greeley's wastewater. They are:

- Delta Mechanical Plant
    - 12 mgd activated sludge plant
- Treatment and Discharge to Crow Creek
    - 24-day lagoon with reservoir storage and discharge
    - 24-day lagoon with direct discharge
    - 4-day lagoon with reservoir storage and discharge
- Treatment and Discharge to Crow Creek and Ogilvy Ditch
    - 24-day lagoon with reservoir storage and discharge
    - 24-day lagoon with direct discharge
    - 4-day lagoon with reservoir storage and discharge
- Land Application System
    - 24-day lagoon with reservoir storage for irrigation
    - 4-day lagoon with reservoir storage for irrigation

Summarized in Table 12, the evaluation matrix, are the impacts associated with each of the nine treatment processes for the following:

- Treatment efficiencies
- effluent quality
- surface water quality
- groundwater quality
- public health
- odor
- visual
- agricultural
- land use
- cost

NO ACTION ALTERNATIVE

This alternative would require that wastewater would continue to be treated at the existing wastewater treatment facilities (First Avenue, Evans, and Hill 'n Park). The First Avenue consists of a South Side trickling filter plant and a North Side activated sludge plant. Currently, these facilities are treating an average of 6.9 mgd. The two systems operate together and have extensive complexities in operation. Treatment efficiencies have improved with the removal of the Monfort packing plant wastes but other industrial facilities wastewater periodically upset the treatment processes. Solids from the facilities must be frequently disposed.

Table 12

IMPACT EVALUATIO

ALTERNATIVE	TREATMENT EFFICIENCIES	EFFLUENT QUALITY	SURFACE WATER QUALITY	GROUND WATER QUALITY	PUBLIC HE
No Action.	Primary and secondary treatment at First Ave. plant: operation is complex due to 2 different treatment processes. Treatment is not consistent due in part to industrial loadings. Primary and secondary treatment at Evans plant: 2 aerated lagoons provide simpler operation. Third lagoon planned would improve efficiencies. Primary and secondary treatment of Hill's Park plant: 2 aerated lagoons provide simpler operation. Efficiency of treatment good.	First Avenue plant BOD - 26 MG/L average, suspended solids - 29 MG/L average. No data for Evans and Hill 'n Park.	First Avenue discharge to Poudre would continue with associated degradation of water quality assuming no improvements. Evans and Hill 'n Park would continue discharge beyond 1995. Minimal impact on water quality.	No effect.	No improvement in recreational use of River for contact. If t efficiencies decrease health risks might slightly from First Av No impact from E Hill' 'n Park.
Delta Site-Mechanical Plant 12 mgd, activated sludge	Primary and secondary treatment No nutrient removal achieved. Operation is less complex than First Avenue plant, but requires knowledge of various treatment processes to achieve effluent quality requirements.	BOD-10mg/l-23mg/l Suspended solids-25 mg/l Nitrogen-17.5 mg/l Salinity-657 micromho/cm Fecal coliform-30 day: 6,000/100ml	Removes discharge from Cache la Poudre R. New discharge to South Platte R. Improves water quality in Poudre, limited degradation to Platte.	No Effect	Improves recreational of Poudre R. for Minimum threat to r to Platte due to i treatment.
24-day detention, 12 mgd. lagoon, reservoir storage, discharge to Crow Creek.	Primary and secondary treatment. Potential for limited nutrient removal in res. Operation is simplified by a minimal amount of mechanical equipment. Additional treatment benefit from reservoir storage prior to discharge. Solids removal infrequent.	BOD-30 mg/l Suspended solids-30 mg/l, variable depending on season and efficiency of micro-strainers Nitrogen-15,5 mg/l Salinity-718 micromho/cm Fecal Coliform-307/100 ML to 5621/100 ML 30 day 6000/100 ML	Removes discharge from Cache la Poudre. New discharge to Crow Creek. Improves water quality in Poudre R. above Crow Creek. No benefit to Crow Creek Water quality, minimal improvement to S. Platte R. below Crow Creek.	No impact expected. Seepage expected from storage reservoir but collect channel at perimeter. Should collect water. No seepage from lined lagoons.	Improved recreation of Poudre R. for above Crow Creek. N to Crow Creek or below Crow Creek.
24 day detention, 12 mgd. lagoon, discharge to Crow Creek.	Primary and secondary treatment. Minimal nutrient removal in lagoons. Operation is simplified by a minimal amount of mechanical equipment. Solids removal infrequent.	BOD-30 mg/l Suspended solids-30 mg/l, variable depending on efficiency of micro-strainers Nitrogen-15.5 mg/l Salinity-657 micromho/cm Fecal coliform - 307/100 ML to 5621/ML	Same as above	No impact expected. Lining of lagoons will prevent seepage.	Same as abov
4-day detention, 12 mgd. lagoon, reservoir storage, discharge to Crow Creek.	Primary and secondary treatment, storage reservoir is intergal part of treatment due to short detention time in lagoon. Operation is simplified by a minimal amount of mechanical equipment, however, maintenance is increased due to more frequent solid removal. Limited nutrient removals	BOD-20 mg/l Suspended solids-30 mg/l, variable depending on season and efficiency of micro-strainers Nitrogen-17 mg/l Salinity-718 micromho/cm Fecal coliform-307/100m/ to 5621/100ml.	Same as above	No impact expected. Seepage expected from storage reservoir but collection channel at perimeter should collect water. No seepage from lined lagoons.	Same as above.

Table 12

CT EVALUATION MATRIX

WATER LITY	PUBLIC HEALTH	ODOR	VISUAL	AGRICULTURAL	LAND USE	COSTS Present Worth High Low
ffect.	No improvement in potential recreational use of Poudre River for contact. If treatment efficiencies decrease, public health risks might increase slightly from First Ave. No impact from Evans and Hill' 'n Park.	Periodic odor generation from industrial wastes likely to impact area around First Avenue. Minimal impact from Evans and Hill 'n Park.	No Change.	Irrigators below dischargers would continue to benefit from nutrient and fertilizer effects. No new agricultural land or protection of agricultural land provided.	Would slow residental and commercial development in the Greeley area.	0
ffect	Improves recreational aspects of Poudre R. for contact. Minimum threat to recreation to Platte due to improved treatment.	Long interceptor from First Avenue may develop odors that would be emitted at influent to plant. As long as aerobic conditions are maintained at plant no odor problems expected.	Extent of negative impact will be dependent on architectural design.	Loss of nutrients in wastewater to irrigators on lower Poudre, benefit to S. Platte irrigators. No new agriculture expected.	Acreage needed: 40-45 acres 100 year flood hazard. Could slow residential development in Delta area.	31,123,150 29,847,150
pected. Seepage storage reser- ect channel at uld collect page from lined	Improved recreational aspects of Poudre R. for contact above Crow Creek. No benefit to Crow Creek or S. Platte below Crow Creek.	Interceptor from Greeley to lagoon potentially will develop odors that would be released at plant. Solids accumulation in reservoir may generate odor that would be released due to lowering water level during discharge. Aeration of lagoons should eliminate odor potential.	Visual impact will be greatest during construction. High effect at site and immediate, surrounding area.	Loss of nutrients to irrigators above Crow Creek confluence. No new agriculture expected.	Acreage needed: 80-90 acres for lagoon, 600 acres for storage reservoir. Will take some agricultural land out of production. Wildlife habitat potential.	37,582,400 32,429,900
expected. Lining ill prevent seep-	Same as above.	Interceptor from Greeley to lagoon potentially will develop odors that would be released at plant. Without reservoir potential for odors reduced. Aeration of lagoons should eliminate odor potential.	Visual impact will be greatest during construction. Limited effect visually at site.	Same as above.	Acreage needed: 80-90 acres for lagoon, no agricultural land taken out of production.	31,846,600 28,144,500
pected. Seepage m storage reser- llection channel should collect page from lined	Same as above.	Same as 24-day detention lagoon, storage reservoir discharge to Crow Creek option.	Similar to 24-day detention, storage reservoir, discharge to Crow Creek.	Same as above.	Acreage needed: 20 acres for lagoon, 600 acres for storage reservoir. Will take some agricultural land out of production. Wildlife habitat potential.	37,161,200 32,008,700

IMPACT EVALUATI

ALTERNATIVE	TREATMENT EFFICIENCIES	EFFLUENT QUALITY	SURFACE WATER QUALITY	GROUND WATER QUALITY	PUBLIC HE
24-day detention, 12 mgd. lagoon, reservoir storage, summer discharge Ogilvy ditch, winter discharge Crow Creek.	Primary and secondary treatment. Potential for limited nutrient removals in reservoir. Operation is simplified by minimal amount of mechanical equipment, however, winter-summer operational requirements increase. Solids removal infrequent.	BOD-30 mg/l Suspended solids - 30 mg/l, variable depending on season and efficiency of micro-strainers Nitrogen-15.5 mg/l Salinity-718 micromho/cm Fecal coliform 307/100ML to 5621/ML	Removes discharge from Cache la Poudre. Winter discharge to Crow Creek not expected to significantly change water quality. Ogilvy Ditch water quality will change depending on amount of dilution available at discharge.	Degree of impact depends on percent of effluent in ditch, groundwater depth, and soils of land irrigated by Ogilvy Ditch. Reservoir seepage should be captured.	High public healt sociated with 100% uncontrolled irrig Improves recreati of Poudre. No ben Creek or Platte.
24-day detention, 12 mgd lagoon, summer discharge Ogilvy Ditch, winter discharge Crow Creek.	Primary and secondary treatment. Minimal nutrient removal in lagoons. Operation is simplified by minimal amount of mechanical equipment, however, winter-summer operation requirements increase. Solids removal infrequent.	BOD-30 mg/l Suspended solids-30 mg/l, Variable depending on efficiency of micro-strainers Nitrogen-15.5 mg/l Salinity-657 micromho/cm Fecal coliform-30 day : 6,000/100ml.	Same as above	Same as above.	Same as abov
4-day detention, 12 mgd. lagoon, reservoir storage, summer discharge Ogilvy Ditch, winter discharge Crow Creek.	Primary and secondary treatment, storage reservoir is integral part of treatment due to short detention time in lagoon. Minimal potential for nutrient removals. Operation is simplified by minimal amount of mechanical equipment, however, winter-summer operation and frequent solids removal increases operational requirements.	BOD-20 mg/l Suspended solids-30 mg/l, Variable depending on season and efficiency of micro-strainers. Nitrogen-17 mg/l Salinity-718 micromho/cm Fecal coliform-307/100ML to 5621/ML	Same as above.	Same as 24-day detention, reservoir storage Ogilvy-Crow Creek option.	Same as ab
24-day detention, 12 mgd lagoon, reservoir storage, land application, ground water collection, discharge to Crow Creek.	Primary, secondary, and tertiary treatment. Lagoon, reservoir, and soils are integral treatment components. High nutrient removals. Operation is less complex due to minimum of mechanical equipment, irrigation-storage functions increase operational requirements. Solids removal infrequent.	BOD-1-2 mg/l in captured groundwater Suspended solids-minimal to none Nitrogen-13.9 mg/l in captured groundwater Salinity-718 micromho/cm Fecal coliform-0-10/100m/ in captured groundwater	Removes discharge from Cache la Poudre R. New discharge to Crow Creek. Water quality in both streams should improve.	No impact expected. Seepage expected from storage reservoir but collection channel at perimeter should collect. Under drain at irrigation site should collect seepage.	Limited public associated with tion provided ad zone established will be restrict edible crops. Co fluent necessary
4-day detention, 12 mgd. lagoon, reservoir storage, land application, ground water collection, discharge to Crow Creek.	Primary, secondary, and tertiary treatment. Lagoon, reservoir, and soils are integral part of treatment. Operation less complex than mechanical plant. However, irrigation-storage functions and frequent solids removal increase operational requirements.	Same as above.	Same as above.	Same as above.	Same as ab

ACT EVALUATION MATRIX *(continued)*

IND WATER UALITY	PUBLIC HEALTH	ODOR	VISUAL	AGRICULTURAL	LAND USE	COSTS Present Worth HIGH LOW
impact depends on effluent in ditch, r depth, and soils rrigated by Ogilvy eservoir seepage captured	High public health risks associated with 100% effluent in uncontrolled irrigation ditch. Improves recreational aspects of Poudre. No benefit to Crow Creek or Platte.	Same as 24-day detention, lagoon, storage reservoir, discharge to Crow Creek.	Same as 24-day detention lagoon, storage reservoir, discharge to Crow Creek.	Nutrients are available for crops. Concentrations of nitrogen and salinity, even with 100 percent effluent will not be injurious to crops. No new agriculture expected.	Acreage needed 80-90 acres for lagoon, 600 acres for storage reservoir. Will take some agricultural land out of production. Wildlife habitat potential.	39,337,800 34,185,300
as above	Same as above.	Same as 24-day detention lagoon, discharge to Crow Creek.	Same as 24-day detention lagoon, discharge to Crow Creek.	Same as above.	Acreage needed 80-90 acres for lagoon, no agricultural land taken out of production.	33,077,200 29,375,100
24-day detention, storage Ogilvy-Crow on.	Same as above.	Same as 24-day detention lagoon, storage reservoir discharge to Crow Creek.	Similar to 24-day detention, storage reservoir, discharge to Crow Creek.	Nutrients are available for crops. Concentrations of nitrogen and salinity, even with 100 percent effluent will not be injurious to crops. No new agriculture expected.	Acreage needed 20 acres for lagoon, 600 acres for storage reservoir. Will take some agricultural land out of production. Wildlife habitat potential.	38,916,600 33,764,100
t expected. Seepage from storage reser- collection channel eter should collect. in at irrigation site llect seepage.	Limited public health risks associated with spray irrigation provided adequate buffer zone established. Irrigation will be restricted to non-edible crops. Control of effluent necessary to limit risks.	Same as 24-day detention lagoon, storage reservoir discharge. Aerobic conditions will prevent odors from land application site.	Same as 24-day detention, storage reservoir, discharge. Conversion of dry land to irrigated with buffer zone will be compatible with existing visual features.	Creates new irrigated agricultural land. Utilizes nutrients and water in crop productions. Protects agricultural use of land but reduces agricultural economy. Concentrations of nitrate should prove beneficial to corn or alfalfa. No effects expected to livestock.	Acreage needed 80-90 acres for lagoon, 600 acres for storage reservoir. Some agricultural land taken out of production. 2,000-3,000 acres of rangeland put into production. Wildlife habitat potential.	37,424,800 32,272,300
ne as above	Same as above.	Same as above	Same as above	Same as above.	Acreage needed 20 acres for lagoon, 600 acres for storage reservoir. Some agricultural land taken out of production. 2,000-3,000 acres of rangeland put into production. Wildlife habitat potential.	37,003,600 31,851,100

The Evans Sanitation District Facilities consist of two aerated lagoons operated in series. The facilities serve approximately 4,500 people. Dentention time in the lagoons is 30 days and discharges about 0.6 mgd. A third lagoon is planned for this facility which would expand treatment. The lagoon systems can be operationally more efficient if operated properly. Sludge disposal would be infrequent.

The Hill 'n Park system consists of two aerobic lagoons which have the flexibility to operate in series or parallel with a detention time of about 52 days. The facility serves approximately 1500 people and has an average daily flow of 0.1 mgd. The operation of this facility is simpler than conventional mechanical facilities. Solids will be removed infrequently which aids in treatment and operational efficiencies.

Effluent Quality

Effluent data were only available for the First Avenue treatment plant. Impacts from the Evans and Hill 'n Park facilities on surface water quality are expected to be minimal with continued operation of the plants. The average BOD effluent concentration from the First Avenue plant in 1979 has been 26 mg/l, with a maximum monthly average of 31 mg/l. The average suspended solids effluent concentration has been 29 mg/l, with a maximum monthly average of 33 mg/l.

Periodic upsets in treatment caused by industrial wastes has lowered effluent quality and created violations of discharge permit requirements. Continued operation of the First Avenue plant is likely to result in further permit violations.

Surface Water Quality

Continued discharge of First Avenue wastewater to the Cache la Poudre with associated violations of permit requirements would contribute to degradation of the stream's water quality.

Discharges from the Evans and Hill 'n Park facilities would continue for the life of these facilities. Treatment is expected to provide an effluent quality which would have a minimal effect on surface water quality. However, receiving streams would be committed to assimilate wastes.

Groundwater Quality

Continued operation of the three facilities would not impact groundwater quality.

Public Health

Operation of the First Avenue treatment plant without improvements would not reduce any potential public health risks. The Cache la Poudre River would not improve as a potential recreational stream, particularly for contact recreation. If operational problems reduce treatment efficiencies at the First Avenue plant, there exists the potential for increases in public health risks.

Health risks associated with discharges from the Evans and Hill 'n Park facilities are not expected to increase providing these facilities function properly.

Odor

Historically, odors have been emitted from the influent structures at the First Avenue Plant. These odors are believed to be associated with industrial wastewaters. These odors are likely to continue with operation of this facility. The areas that would be impacted from odors are shown in Exhibit 4, Page .

Minimal odor impacts are expected from the Evans and Hill 'n Park facilities provided aeration is provided to the wastewaters.

Visual

Visual features at the First Avenue Plant and the Hill 'n Park plant would not change with continued operation. The addition of a third lagoon at the Evans facility would create a localized visual impact, however, this is not considered to be a significant impact.

Agriculture

Existing agricultural lands below all discharges which use discharge receiving waters for irrigation would continue to benefit from nutrients and fertilizing features of the water. However, this option does not provide for the protection or expansion of agricultural land in the Greeley area.

Land Use

Residential and commercial growth would be limited because additional wastewater could not be adequately treated with the existing facilities.

Costs

There are no capital costs for this alternative.

ALTERNATIVE 1 - Mechanical Plant at Delta Site

A new activated sludge treatment plant would be built at the Delta Site, effluent would be discharged to the South Platte River. The proposed facility would have a design capacity of 12 million gallons per day (mgd).

Consistent treatment performance of this plant would be highly dependent on the control of high strength/toxic, slug loads of industrial wastes which have periodically upset the First Avenue treatment plant. This facility would provide both primary and secondary treatment of the wastewater. It is expected that nitrogen compounds will undergo conversion, but no removal of any nutrients in the wastewater is expected.

Effluent Quality

Activated-sludge plants, like the proposed Delta plant, when operated properly and are not upset by industrial inputs, have the ability to meet discharge requirements of 30 milligrams per liter (mg/l) biochemical oxygen demand (BOD) and 30 mg/l suspended solids (SS). Effluent quality of the proposed Delta plant is expected to range from 10 mg/l and 23 mg/l BOD and 25 mg/l SS. The treatment plant is expected to reduce total nitrogen concentrations by 32 percent. Based on an influent concentration of 25 mg/l, the effluent concentration is expected to be about 17.5 mg/l. The total nitrogen component would consist of the following forms of nitrogen:

Ammonia - 35 percent
Organic Nitrogen - 27 percent
Nitrate + Nitrite - 38 percent

Fecal Coliform concentrations in the effluent for any 30 day average are expected to be about 6,000/100 milliliters (ml) and for any seven day average, 12,000/100 ml. This facility would not result in any reductions in salinity.

Surface Water Quality

Beneficial water quality impacts to the Cache la Poudre River will occur by implementing this alternative. Currently, water quality in the lower Cache la Poudre is being impacted by irrigation return flows and the First Avenue treatment plant. The South Platte River's water quality will be degraded since an additional discharge will require assimilation. The discharge would likely be upstream from the confluence of the Cache la Poudre with the South Platte, thus benefits gained in dilution previously realized will be lost due to change of receiving stream and point of discharge. Waste load allocations and water quality modeling conducted by the Larimer-Weld COG for the Water Quality Management Plan indicate that secondary treatment at the Delta plant would not be sufficient in attaining water quality standards. Discharge of a 30 mg/l BOD and 15 mg/l ammonia (RM 248.2) will cause the instream ammonia level to reach 11.6 mg/l and remain above 1.5 mg/l until river mile 230.8 where return flows provide acceptable water. The DO standard is also exceeded until the confluence with the Cache la Poudre River at mile 247.7 provides sufficient oxygen to raise the instream DO above 5.0 mg/l." Even if the plant were upgraded to tertiary treatment, dissolved oxygen and ammonia standards would continue to cause violations one half mile below point of discharge until dilution with the Cache la Poudre River.

Groundwater Quality

Groundwater will not be effected as a result of this alternative.

Public Health

The health risks associated with contact of the effluent are greatly reduced since dilution will begin immediately upon discharge to the South Platte. The Cache la Poudre will improve as a recreational stream with public health risks reduced by removing the First Avenue discharge. The segment of the river that will be improved is from the First Avenue point of discharge to the confluence of the Poudre and Platte Rivers. The effect of the effluent on public health in the South Platte is further discussed by improved wastewater treatment.

Odor

Wastewater treated at the Delta site wastewater will be conveyed from the First Avenue plant and the southeast interceptor. Long residence time in the pipeline increases the potential for odors to develop. Influent, if exposed to the air upon entering the treatment plant, would emit odors. The potential areas that would be effected before a violation of seven to one dilutions and fifteen to one dilutions are shown in Exhibit 13.

Visual

The Delta treatment plant will have some impact on the visual features of the immediate site and adjacent area. The extent of this impact will be contingent upon final architectural design. Variations include warehouse type appearance to low profile contemporary styling.

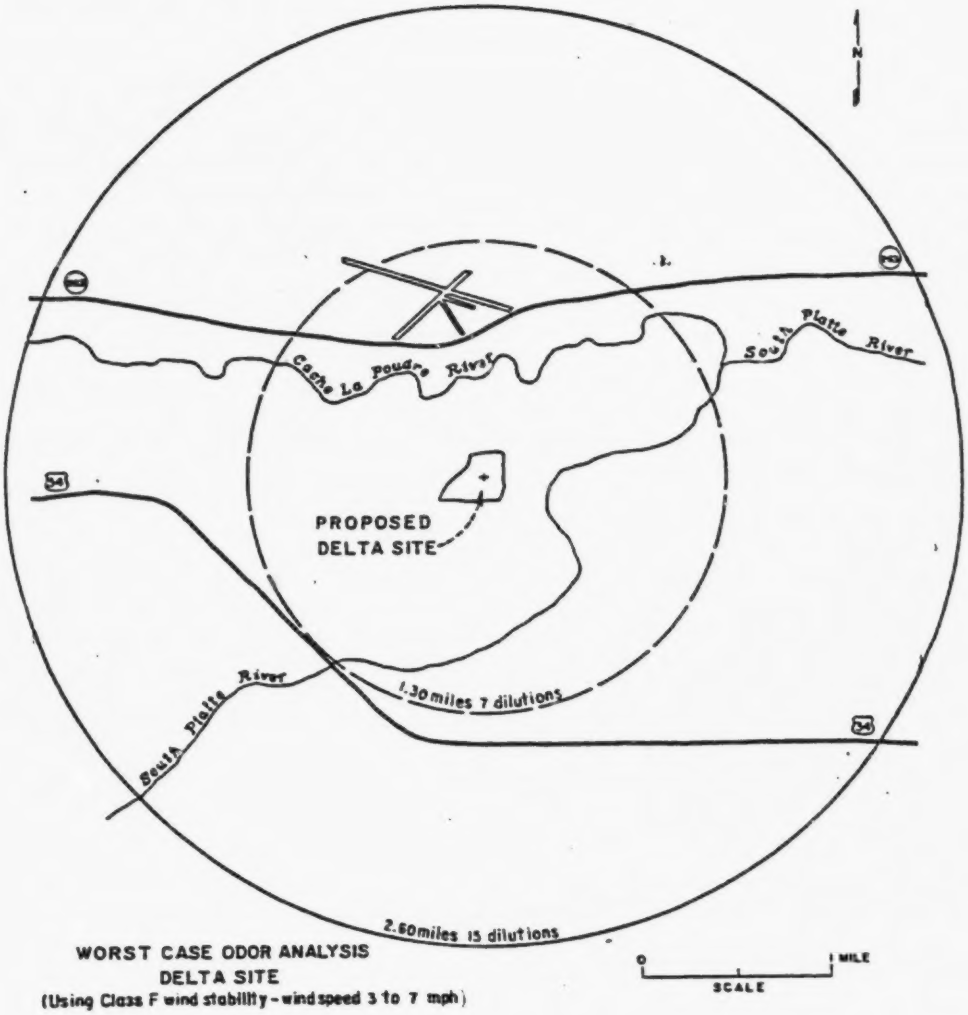
Agricultural

This alternative does not increase or preserve agricultural land of the area. Changing the point of discharge results in the loss of the nutrient and fertilizer benefits the wastewater provided to irrigators along the Cache la Poudre below the existing discharge point.

Land Use

The Delta site currently is a low density area. The primary land use is agricultural with some residential. The county airport is located a short distance to the north of the Delta. If the Delta alternative was to be selected, 45 acres would be required for facility location. No single piece of property can be found above the 100-year flood level. Consequently, flood proofing of the facility would become necessary.

Land use impacts associated with the construction of a wastewater treatment facility would primarily be reflected in a slowing of residential development in this area. This could possibly lead to the establishment of some light industry and warehousing. Basic land use patterns would not be altered in the short term. Long term consequences would depend on whether the facility operated at designed standards.


N
Cache La Poudre River
South Platte River
South Platte River
34
34
PROPOSED
DELTA SITE
1.30 miles 7 dilutions
2.60 miles 15 dilutions
0
1 MILE
SCALE

WORST CASE ODOR ANALYSIS
DELTA SITE
(Using Class F wind stability - windspeed 3 to 7 mph)

LEGEND

——— Estimated area exceeding 15 dilutions
— — Estimated area exceeding 7 dilutions

EXHIBIT 14

Costs

The high and low cost estimates for this alternative are $31,123,150 and $29,847,150 respectively. All costs are in 1979 dollars.

ALTERNATIVE 2 - 24-Day Detention Lagoon, Storage Reservoir, Discharge to Crow Creek

This alternative consists of a 24-day detention time, aerated, two cell lagoons with a design flow of 12 mgd. The site of this facility is east of Crow Creek. The wastewater would receive secondary treatment in the lagoons then would receive a final polishing in the storage reservoir before discharge to Crow Creek. This treatment process would not achieve any significant amount of nutrient removals. The operation and maintenance of the treatment process would be reduced compared to a mechanical facility once operational conditions in the lagoons were established. Sludge would accumulate in the lagoons and to a lesser degree in the storage reservoir. Preliminary design features of the lagoons indicate there is a potential for short-circuiting, thus reducing detention time and treatment of the wastewater. Relocation of the inflow and/or outflow structures can eliminate this potential problem. Suspended solids removal may not be as high due to algal growth and seasonal changes in the pond.

The storage reservoir would be designed as either a one or two cell system with a preliminary design detention of 160 days. Additional suspended solids removal will occur in the reservoir as well as some natural disinfection. The reservoir will be subject to algal blooms and seasonal turnovers which may effect suspended solids concentrations in the effluent. Location of the reservoir in Section 31 would require the diversion of storm water from a tributary of Crow Creek. This diversion would begin north of the reservoir and would be directed back to its original course south of the facilities. In addition, the storage reservoir could become a potential wildlife habitat for duck, geese, and other water fowl. This could increase hunting capabilities in the area.

The efficiency and reliability of this facility is highly dependent on controlling industrial wastewater discharges to the system.

Effluent Quality

This alternative has been designed to produce an effluent which meets or exceeds the BOD and suspended solids discharge permit requirements of 30 mg/l. In addition, nitrification and some nutrient removal may occur in the storage reservoir. With the exception of nutrient removal and nitrification, the effluent is expected to be similar to that produced by the Delta mechanical plant. However, algal blooms and seasonal turnover in the reservoir may cause occasional high discharges of suspended solids. Successful operation of the micro-strains will govern if violations occur. No reductions in salinity are expected in the lagoons, and, because of evaporation in the reservoir, it is expected that salinity concentrations may increase. Fecal coliform concentrations should be less than in a mechanical plant since bacteria die-off will occur in the reservoir.

Surface Water Quality

The point of discharge is removed from the Cache la Poudre river. This will have a beneficial impact on the streams water quality. Crow Creek is composed primarily of irrigation return flows and runoff. Discharging wastewater will have a negative impact on the streams quality, particularly with regard to nitrogen concentrations and salinity. Both of these parameters are likely to increase below the discharge point. Crow Creek is currently unclassified, therefore, impacts to designated uses cannot be assessed. Concentrations of these parameters are expected to be below livestock and crop tolerance limits but higher than historically experiended.

Crow Creek is tributary to the South Platte River. The impact of a treated wastewater in Crow Creek on the South Platte will be similar to the Delta mechanical plant.

The storage reservoir will provide a great amount of flexibility which can further minimize impacts. Should algal growths or turnover cause the water quality to be incapable of meeting permit requirements, release could be withheld.

Groundwater Quality

Soils analysis indicate high permeabilities. The storage reservoir would be only partially lined. Therefore, seepage from the reservoir is expected. Based on data from the Muskegon Project, which has similar site and design features, there is the potential for as much as 3.5 mgd of treated effluent seeping through the bottom of the reservoir. Preliminary design plans require the construction of a ditch around the outer perimeter of the reservoir to intercept the seepage water. The success of this ditch in capturing seepage will depend on the depth to seasonal groundwater and the depth to an impervious substrate. Currently, these data are not available. However, if the bedrock would prove to be pervious in places, wells and pumps could be added to control seepage as a mitigating measure.

The captured water would be monitored for its quality and if acceptable, would be discharged to Crow Creek. If the water quality is not suitable for discharge, it would be returned to the lagoons for treatment. Current preliminary design does not indicate if this additional flow is factored into the treatment process.

The treatment lagoons will be lined with impervious material, therefore, no groundwater impacts would occur from raw or partially treated wastewater.

Public Health

Health risks associated with treated wastewater from Greeley discharged to the Cache la Poudre River will be removed. This will improve the potential recreational use of this river. Health risks in Crow Creek and the South Platte River are not expected to change provided the wastewater receives some detention time in the storage reservoir and disinfection prior to discharge. However, disinfection efficiencies can be reduced if the discharged water is high in suspended solids. The suspended solids will have a masking effect on bacteria, reducing their contact with the chlorine and increasing health risks associated with the discharged wastewater.

Odor

Long residence times in the transmission lines from Greeley to the lagoons increases the potential for odors to develop. The odor would be released to the atmosphere at the influent structure to the lagoon if it were not submerged. The potential also exists that some decaying material which settles in the reservoir might be exposed during discharge/drainage which may also be odorous. Aeration of the treatment lagoons will eliminate the potential for odors to form in these structures. The areas that would be effected before a violation of the seven to one dilution and fifteen to one dilution State regulations are shown in Exhibit 15.

Visual

The proposed reservoir and lagoons will alter the topographic features of the immediate area. The greatest impact will occur during construction when exposed soil will contrast with surrounding vegetation. However, as vegetation establishes on the slopes of the facility, this impact will be significantly reduced. Analysis of the visual features of the area indicates that the rolling terrain of the area will aid in further reducing the visual effects beyond the immediate site.

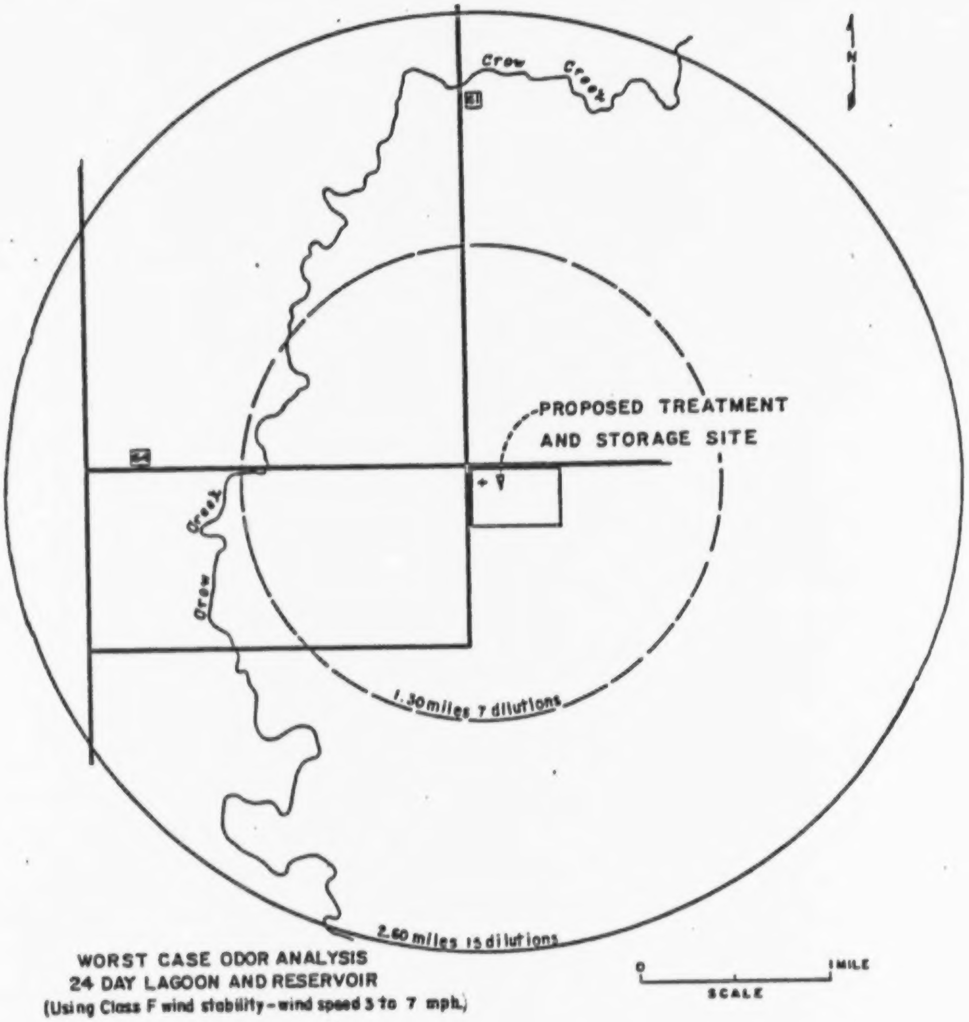
An exaggerated cross-section of the 24-day lagoon is presented in Exhibit 16.

Agriculture

This alternative neither protects prime agricultural land nor provides additional agricultural land. Wastewater nutrients and fertilizing benefits will be lost to irrigators below the First Avenue discharge. Irrigators using Crow Creek below the proposed discharge may realize some benefit of these parameters, providing water is available for their use.

Land Use

Impacts of this alternative on the existing land uses will be twofold. First, there are those temporary disruptions on the land that will occur during the construction phase of the various transmission lines and second, there will be the more permanent effects associated with the location of treatment facilities, lagoons, and storage reservoir.


N
Crow Creek
Crow Creek
PROPOSED TREATMENT AND STORAGE SITE
1.30 miles 7 dilutions
2.60 miles 15 dilutions
0
1 MILE
SCALE

WORST CASE ODOR ANALYSIS
24 DAY LAGOON AND RESERVOIR
(Using Class F wind stability-wind speed 3 to 7 mph.)

LEGEND

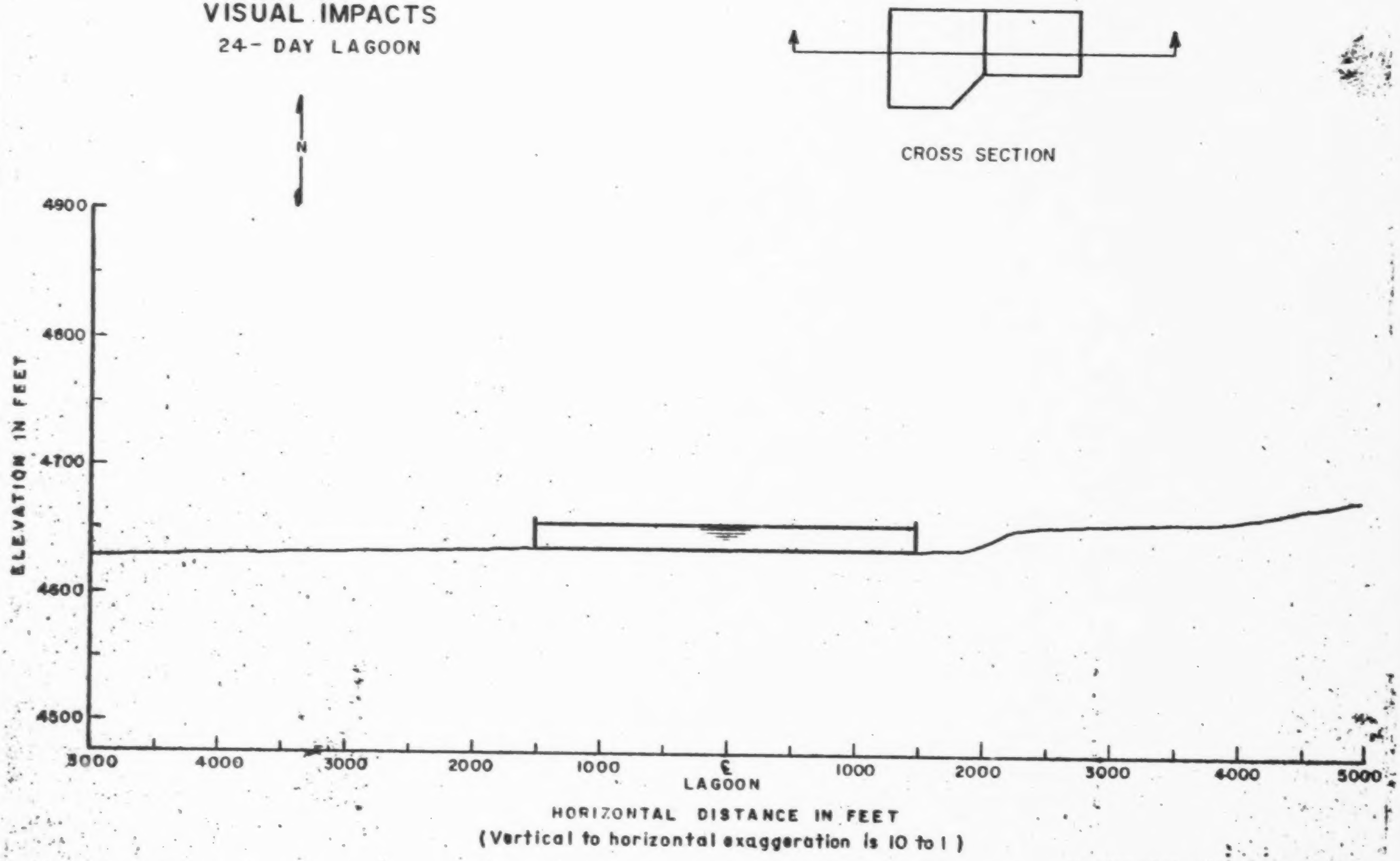
- —— Estimated area exceeding 15 dilutions
- — — Estimated area exceeding 7 dilutions

EXHIBIT 15

EXHIBIT 15

VISUAL IMPACTS

24- DAY LAGOON


N
CROSS SECTION
ELEVATION IN FEET
4900
4800
4700
4600
4500
5000
4000
3000
2000
1000
℄
LAGOON
1000
2000
3000
4000
5000
HORIZONTAL DISTANCE IN FEET
(Vertical to horizontal exaggeration is 10 to 1)

Horizontal 1 in. = 1000 ft.
Vertical 1 in. = 100 ft.

Under the 24-day lagoon alternative, 80 to 90 acres will be needed to accommodate all lagoon and treatment facilities. A storage reservoir will require an additional 600 surface areas. Up to 320 acres of irrigated cropland will be taken out of production. The remaining area needed to accommodate the proposed storage reservoir will be unirrigated rangeland.

Costs

The high and low cost estimates for this alternative are $37,582,400 and $32,429,900 respectively. These costs are in 1979 dollars.

ALTERNATIVE 3 - 24-Day Detention Lagoon, Discharge to Crow Creek

This alternative is identical to the system described under Alternative 2 but without the storage reservoir. Eliminating the storage reservoir improves the operation and maintenance of the treatment system. However, certain treatment efficiencies and flexibility are lost. Discharge to Crow Creek under this Option is continued, no flexibility for controlled discharges is available. Additional removal of suspended solids will occur beyond the second lagoon. However, the potential for increased algal/suspended solids concentrations associated with the reservoir is eliminated.

Effluent Quality

This system is designed to meet the discharge permit requirements of 30 mg/l BOD and suspended solids concentration. However, this process will not provide supplemental treatment beyond secondary. Suspended solid discharge requirements have a higher probability of being met since any algal blooms or effect of turnovers will be confined to the lagoons and not include the reservoir. No nitrification or nutrient removals are likely to occur in the lagoons. This option will possibly be more compatible with the micro-strainers since it is anticipated that suspended solids will be less of a problem. Should temporary upsets in treatment occur, potential for discharging a lower quality effluent becomes possible. Proper design and operation should consistently produce an effluent quality that meets permit requirements.

Surface Water Quality

The First Avenue Treatment Plant discharge is removed from the Cache la Poudre; impacts are beneficial as described previously. The most significant water quality impact will be to Crow Creek, which will receive the entire effluent discharge throughout the year. The water quality impact will vary depending upon the time of year and the consistency of the treatment process. With consistent treatment process performance, the impact on Crow Creek water quality should be minimal most of the year and could be beneficial during the summer when the flow consists largely of agricultural return flow.

If process upsets cause discharges of effluent containing large quantities of algae, the impact on Crow Creek will be detrimental. If this occurs during periods when agricultural return flows are carrying nutrients into the creek, then algae blooms may occur with concomitant odors, and water quality and aesthetic problems. This would cause reduced water quality in the South Platte River below the mouth of Crow Creek.

Groundwater Quality

The treatment lagoons are designed to be lined. Depending upon the final design material and its thickness, this material should prevent any seepage into the groundwater. Should seepage occur, monitoring of the groundwater would be necessary to evaluate the extent and severity of any groundwater impacts.

Public Health

Public health risks that could develop as a consequence of this option will be similar to those described under Alternative 2. Elimination of the reservoir removes some of the die-off time for bacteria that additional storage would provide but reduces the potential for algal/suspended solid masking. This option, therefore, provides no significant benefit to public health over Alternative 2.

Odor

Odor formation in the long transmission from Greeley and the spheres of influence/impact will be the same as Alternative 2. This Option by elimination of the storage reservoir reduces a source of potential odors.

Aeration of the treatment lagoons will prevent odor generation resulting from treatment.

Visual

Visual impacts will be identical to those described under Alternative 2. The greatest impacts will be during construction. Elimination of the reservoir will proportionately reduce impacts adjacent to site.

Agricultural

This alternative neither protects existing agricultural nor provides additional agricultural land. Impacts are the same as Alternative 2.

Land Use

Land use impacts for this alternative are the same as Alternative 2 except that no acreage would be needed for a storage reservoir. Therefore, no agricultural land would be taken out of production.

Costs

The high and low cost estimates for this alternative are $31,846,600 and $28,144,500 respectively. All costs are in 1979 dollars.

ALTERNATIVE 4 - 4-Day Detention Lagoon, Storage Reservoir, Discharge to Crow Creek

The storage reservoir is an integral and necessary component of this treatment option. Two lagoons each with a two day detention time would be aerated. Aeration would be accomplished by fixed platform, mechanical aerators instead of the coarse-bubble compressed air diffusion designed for the 24-day detention lagoons. Operation and maintenance of this process is likely to be higher. This is, in part, the result of the need for more frequent solids removal from the lagoons and possibly the reservoir.

This process would also be somewhat more sensitive to shock organic or toxic loads which would disrupt the treatment process. This type of system is often designed as a three cell lagoon system because greater operational flexibility can be achieved.

The lagoons and reservoir are designed to achieve secondary treatment. Micro-strainers prior to chlorination will aid in achieving the discharge permit requirement of 30 mg/l BOD and suspended solids. The reservoir will provide additional solids removal and may achieve some nutrient removal and nitrification. The storage reservoir will operate in similar manner as Alternative 2, but could be designed to a smaller capacity. This facility would function as a polishing pond for the wastewater prior to chlorination and discharge.

Effluent Quality

Short detention time in the lagoons require high aeration to reduce BOD prior to storage. Additional BOD reduction is likely to occur in the storage reservoir. Suspended solids removal and generation will be similar to that described in Alternative 2. Depending upon the efficiency of the micro-strainer, and algal blooms and season turnovers, suspended solids in the effluent will vary. Salinity in the influent wastewater will potentially be increased due to water losses through reservoir evaporation. Fecal coliform bacteria may be masked during disinfection if the micro-strainers are not efficient in suspended solids removal, thereby reducing the efficiency of chlorination.

Surface Water Quality

Impacts to surface water quality are expected to be the same as those described under Alternative 2.

Groundwater Quality

Lining of the treatment lagoons will eliminate the potential for seepage of raw or partially treated wastewater. Seepage is expected from the storage reservoir. Final design and success of seepage capture will depend upon depth to groundwater and impervious substratum as described under Alternative 2. Proper construction should capture the majority of the seepage water thus minimizing any impacts to groundwater. Captured groundwater would be monitored for quality and if acceptable, would be discharged to Crow Creek. Captured groundwater that was deemed unsuitable for discharge would be returned to the lagoons for treatment. Capacity of the lagoons may need to be adjusted in final design to account for this additional water.

Public Health

Public health risks associated with this alternative will be similar to those discussed under Alternative 2. The greater sensitivity of the 4-day lagoons increases the potential for system upsets and associated public health risks. However, operation of the reservoir inhibits the discharge of partially treated wastewater.

Odor

Potential for the development of their emission is the same as those described under Alternative 2. Since the reservoir will likely accumulate more solids than the reservoir associated with Alternative 2, odor impacts associated with draining/drawing down the reservoir will be greater. The area that will be affected by nuisance odors are illustrated in Exhibit 17.

Visual

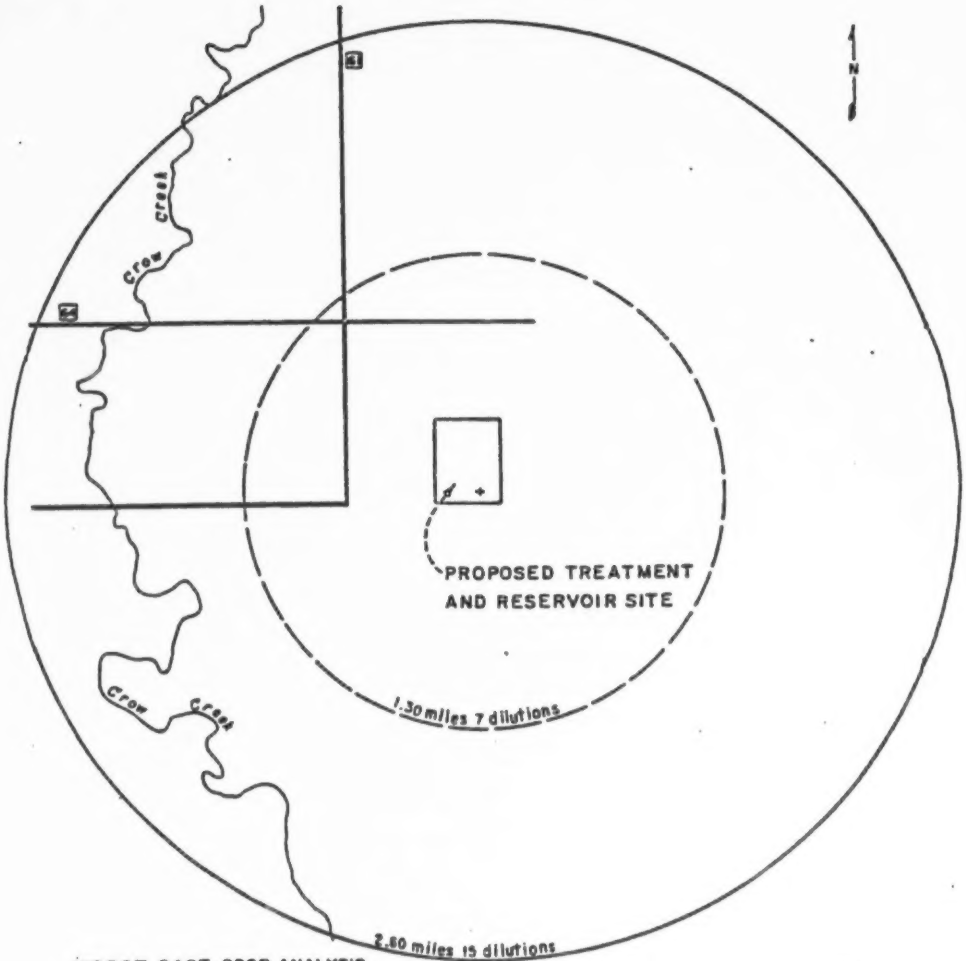
Construction of the 4-day lagoons would require less land and would be located away from county roads thus reducing the visual impact. An exaggerated cross-section of the 4-day lagoons is illustrated in Exhibit 18. Visual impacts of the reservoir would be greatest during construction as described under Alternative 2.

Agriculture

Impacts on agriculture would be the same as described under Option 2.

Land Use

As in the previous alternatives, the laying of transmission lines would cause temporary disruption to the land. In utilizing the reservoir, up to 320 acres of agricultural land would be taken out of production. A total of 600 surface acres would be needed for the entire reservoir. The four-day treatment lagoon would require approximately 20 acres.


N
Crow Creek
PROPOSED TREATMENT AND RESERVOIR SITE
1.30 miles 7 dilutions
Crow Creek
2.60 miles 15 dilutions

WORST CASE ODOR ANALYSIS
4 DAY LAGOON AND RESERVOIR
(Using Class F wind stability - wind speed 3 to 7 mph.)

0 — 1 MILE
SCALE

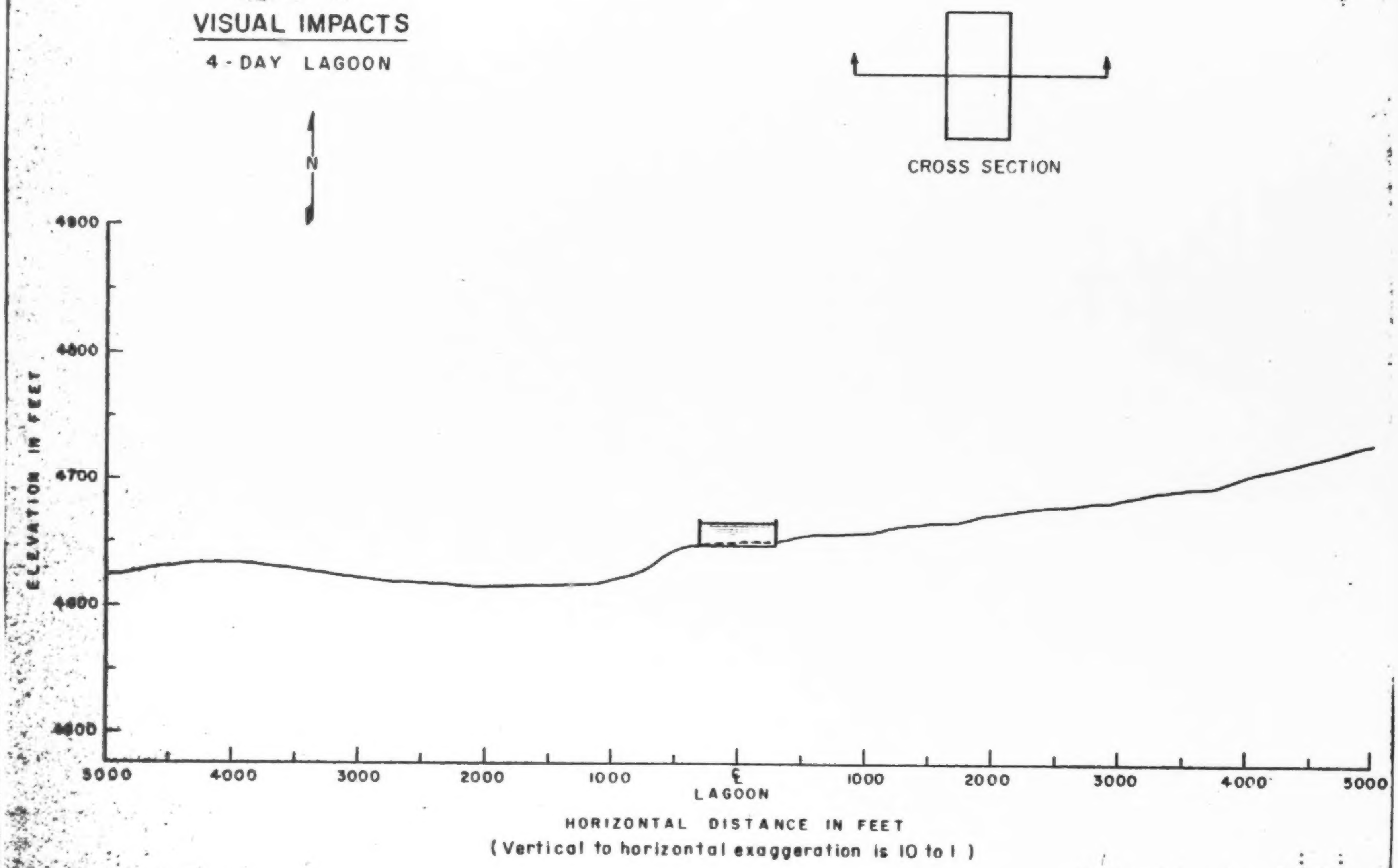
LEGEND
——— Estimated area exceeding 15 dilutions
— — Estimated area exceeding 7 dilutions

EXHIBIT 17

EXHIBIT 18

VISUAL IMPACTS

4 - DAY LAGOON



HORIZONTAL DISTANCE IN FEET

(Vertical to horizontal exaggeration is 10 to 1)

Horizontal 1 in. = 1000 ft.
Vertical 1 in. = 100 ft.

Costs

The high and low cost estimates for this alternative are $37,161,200 and $32,008,700 respectively. All costs are in 1979 dollars.

ALTERNATIVE 5 - 24-Day Detention Lagoon, Storage Reservoir, Summer Discharge to Ogilvy Ditch, Winter Discharge Crow Creek

This alternative is identical to Alternative 2 with the exception of the seasonal discharge. Secondary treatment can be achieved as well as minimal nutrient removal in the storage reservoir. Accumulated sludge in the treatment lagoons would require infrequent removal. The preliminary lagoon design indicates a potential for short-circuiting, resulting in a lower level of treatment if not corrected in final design.

Impacts of this alternative will be the same as those discussed in Alternative 2, except during the summer. Only these variations will be discussed below.

Effluent Quality

The effluent quality will be the same as that discussed in Alternative 2. BOD and suspended solids concentration in the effluent can be 30 mg/l for each parameter. Suspended solids are likely to vary in the reservoir but successful operation of the micro-strainers should provide an effluent within permit requirements. Salinity will probably increase due to evaporation losses in the reservoir to about 718 micromho/cm. Fecal coliform will vary from 307/100 ml to 5621/100 ml.

Surface Water Quality

Impacts to the water quality of Crow Creek would be as described in Alternative 2.

Summer discharge to Ogilvy Ditch would result in a variation in water quality. The variation in quality will depend on the flow and quality of the water in the Ditch at the discharge point. It is expected that during particular times during the summer, the Ditch would contain 100 percent effluent. This is considered the worst case condition, since water quality would be that discussed under effluent quality.

Groundwater Quality

Groundwater quality at the treatment lagoons and storage reservoir would be the same as that described in Alternative 2.

Discharge to Ogilvy Ditch and subsequent use for irrigation should not adversely effect groundwater below the irrigated land. During times when 100 percent effluent is in the Ditch and flows over the land, groundwater should not be effected since soil filtration would further treat the wastewater.

Discharge to Ogilvy Ditch would occur during the irrigation season, therefore, nutrients in the wastewater would be utilized by the crops. This feature would minimize the potential for buildup of nutrients, particularly nitrates, in the soil.

Public Health

Public health risks occur when 100 percent effluent would be in Ogilvy Ditch. This situation represents a health risk because the City of Greeley is no longer in control of the wastewater and public exposure to the effluent is unrestricted. The reuse of wastewater, when out of the control of the municipality, should provide for the protection of the public health both during agricultural uses and public exposure. Data on public health risks relative to irrigation with wastewater is conflicting and is reflected in the lack of uniform requirements or standards covering such use. The data on public health hazards associated with uncontrolled access/use of treated wastewater are virtually non-existent. The proposed Colorado primary contact recreational bacteriologic standard of 200 fecal coliform organisms per 100 ml is a reasonable bacteriological criteria for discharge of the treated wastewater to Ogilvy Ditch. This standard would be compatible with unrestricted public access to the canal system. This bacteriological discharge level of the effluent would provide a relatively high level of pathogen control, but the presence of pathogenic organisms in the Ditch water can be expected. The anticipated effluent fecal coliform concentration for this option will not achieve 200/100 ml based on existing preliminary design.

Odor

Odor impacts of this alternative would be the same as described under Alternative 2. The areas that would be affected by nuisance odors in excess of State regulation are illustrated in Exhibit 14 on Page .

Visual

This alternative would have the same visual impacts as Alternative 2. The visual cross-section of the 24-day detention lagoon is illustrated in Exhibit 15 on Page .

Agricultural

Crops irrigated by the Ogilvy Ditch would benefit from the wastewater discharged in the summer. Concentration of nitrogen and salinity when 100 percent effluent is used would not be detrimental to crops. No additional irrigated agricultural land would be developed but some protection of existing agriculture is provided by committing the ditch to receive effluent.

Provisions would be necessary to prevent the irrigation of raw edible food crops with the effluent. There is also a potential operational problem of discharging to the Ditch when land could not be irrigated or was not available for irrigation in the summer. However, flexibility in the system may allow discharge to Crow Creek in the summer during these periods.

Land Use

This alternative needs 80-90 acres for the lagoon and 600 acres for the storage reservoir. The reservoir will take up to 320 acres of agricultural land out of production. Temporary impacts on the land will occur as a result of the laying of an additional line to transmit treated wastewater to Ogilvy Ditch.

Costs

The high and low cost estimates for this alternative are $39,337,800 and $34,185,300 respectively. All costs are in 1979 dollars.

ALTERNATIVE 6 - 24-Day Detention Lagoon, Summer Discharge Ogilvy Ditch, Winter Discharge Crow Creek

This alternative, with the exception of the summer discharge to Ogilvy Ditch, is identical to Alternative 3. The treatment achieved would be to a secondary level. Operational requirements would be slightly greater due to changes required in the point of discharge. The impacts resulting from this alternative would be the same as those identifed for Alternative 3 relative to treatment efficiencies and effluent quality, and the same for the other categories as discussed in Alternative 5.

Effluent Quality

The benefit of not having the storage reservoir is a potential reduction in suspended solids and salinity in the effluent. However, no nutrient removals are likely to occur in the treatment lagoons, and the potential for bacteria die-off that can occur in reservoirs is not likely, thus increasing coliform counts. Effluent quality will be the same as that discussed under Alternative 3.

Surface Water Quality

Impacts to Crow Creek water quality during the winter would be the same as those discussed under Alternative 3. Summer discharge to Ogilvy Ditch under this alternative would have similar impacts on water quality as described under Alternative 5. The worst case water quality impacts would be associated with 100 percent effluent. The relative concentrations of parameters would vary between Alternative 5 and Alternative 6 as described under the effluent quality produced, respectively.

Groundwater Quality

The impacts on groundwater quality resulting from this alternative would be the same as those identified in Alternative 5.

Public Health

The relative public health risks of this option would be greatest when 100 percent effluent would have uncontrolled use in Ogilvy Ditch. Fecal coliform concentrations prior to chlorination are likely to be higher since the potential for additional die-off provided by the reservoir is eliminated; thus higher chlorination may be required. However, there is the possibility that the masking effect of suspended solids on disinfection may be reduced without the reservoir, thus off-setting the need for additional chlorination.

When discharging to Ogilvy Ditch, it is proposed that 200/100 ml fecal coliform be achieved in the effluent to provide a suitable degree of public health protection.

Odor

The potential for odor development and emission along with the resultant impact would be the same as those discussed under Alternative 3.

Visual

Visual impacts would be the same as those discussed in Alternative 3.

Agriculture

The impacts to agriculture would be confined to lands irrigated by the Ogilvy Ditch. These effects would be the same as those discussed under Alternative 5.

Land Use

The 24-day lagoon would require 80-90 acres. No agricultural land would be taken out of production.

Costs

The high-low cost estimates for this alternative are $33,077,200 and $29,375,100 respectively. All costs are in 1979 dollars.

ALTERNATIVE 7 - 4-Day Detention Lagoon, Reservoir Storage, Summer Discharge Ogilvy Ditch, Winter Discharge Crow Creek

This alternative is the same as Alternative 4 with the exception of the flexibility to discharge to Ogilvy Ditch during the summer. Treatment efficiencies, operational features, and treatment levels achieved would be the same as those identified in Alternative 4. The only variation is in the season discharge points.

Effluent Quality

Effluent quality produced by this process would be the same as that discussed under Alternative 4. The BOD concentration may be slightly less than options using the 24-day lagoons due to the need for higher aeration requirements of short detention lagoons. Salinity may increase in the reservoir during detention due to evaporation loss. Fecal coliform bacteria may experience some die-off in the storage reservoir decreasing counts; however, suspended solids may increase in the reservoir due to algal blooms.

Surface Water Quality

The impacts on Crow Creek water quality during winter discharge would be the same as those discussed under Alternative 4. Impacts on the water quality of Ogilvy Ditch would be the same as those discussed under Alternative 5.

Groundwater Quality

The impacts to groundwater quality at the treatment and reservoir site would be the same as those discussed under Alternative 4. The effects on groundwater under lands irrigated with the effluent are also discussed under Alternative 4.

Public Health

The public health risks associated with this alternative are associated with the potential for uncontrolled use of and access to 100 percent effluent. The health risks of this situation are the same as those discussed under Alternative 5.

Odor

The potential for odor problems and the area that would be affected is the same as Alternative 4. The potential area of impact is shown in Exhibit 16, Page .

Visual

Visual impacts of this alternative would be the same as those identified in Alternative 4. The exaggerated cross-section, Exhibit 17, Page , is also applicable to this option.

Agriculture

Beyond the benefit of providing nutrients to crops irrigated by the Ogilvy Ditch, impacts to agriculture would be the same as those identified under Alternative 5.

Land Use

The 4-day lagoon will require 20 acres. The storage reservoir will require 600 surface acres. Will take approximately 320 acres out of agricultural production.

Cost

The high-low cost estimates for this alternative are $38,916,600 and $33,764,100 respectively. All costs are in 1979 dollars.

ALTERNATIVE 8 - 24-Day Detention Lagoon, Reservoir Storage, Land Application for Crop Production, Groundwater Collection, Discharge to Crow Creek

Facilities that comprise this alternative include aerated treatment lagoons with a total detention time of 24 days and a design flow of 12 mgd. These lagoons would be constructed east of Crow Creek. The treated effluent from these lagoons would be discharged to a large storage reservoir for final effluent polishing and winter storage. During the summer, water from the reservoir would be used to spray irrigated crops through center pivot sprinklers for nutrient removal, and additional treatment by soil filtration. Wastewater not lost through evaporation, and crop uptake would be collected by underdrains and discharged to Crow Creek. The treatment process and design of the lagoons and reservoir would be identical to those of Alternative 2, 3, 5 and 6. However, treatment efficiencies would be greater. The nutrient removals achieved by crop uptake and additional treatment provided by soil filtration would provide tertiary treatment.

Operational requirements would be more involved than other options since storage and releases from the reservoir would depend on growing season and farming practices at the land application site. Current preliminary design features do not provide sufficient winter storage in the reservoir (160 days) if irrigation can only occur for 20 weeks. Additionally, prior to conveyance of the effluent from the reservoir to the sprinklers, screening would occur to remove suspended solids and algae which could interfere with the sprinkler operation. In addition to surface drainage impact associated with the reservoir, some subsurface drainage will be diverted into the reservoir due to the addition of underground collectors with this alternative. This impact is seen as minimal.

Effluent Quality

The effluent from this system is expected to be of very high quality, with BOD and SS less than 10 mg/l and essentially free of nutrients and ammonia. This system is modelled after the successful Muskegon, Michigan land application system, which consistently produces a high quality effluent.

It is expected that the Greeley system may experience problems of algal growth in the reservoir which is not experienced at Muskegon. This could result in problems with pumping and spraying the effluent.

This alternative would remove the existing First Avenue treatment plant discharge from the Cache la Poudre River. Treated effluent would be discharged to Crow Creek. The Hill 'n Park and Evans discharges would continue until 1995, at which time they would be abandoned and their flows diverted to the new facility for treatment and disposal. This alternative produces the highest quality of effluent of the alternative evaluated.

Surface Water Quality

The impact on the Cache la Poudre River water quality would be identical to Alternative 2. The option would have a net positive effect on the river water quality. The South Platte River water quality would improve when the Hill 'n Park and Evans discharges were removed.

Crow Creek would receive the treated effluent discharged from the land application facilities. This discharge would occur from March to October, and is expected to be of very high quality. The flow in Crow Creek during these periods consists largely of agricultural irrigation return flows which is poor in quality. Crow Creek water quality could therefore be improved by the addition of this discharge. This water would eventually flow into the South Platte River, and would have a slight beneficial effect on the river water quality.

The net effect of this alternative on surface water quality is beneficial. There will be no significant impact on livestock watering requirements.

Groundwater Quality

Impacts to the groundwater under the lagoon and reservoir would be the same as those discussed in Alternative 2. It is anticipated that the underdrains at the land application site would capture old effluent that percolated through the soil. Therefore, minimal impacts to groundwater at the land application site are expected.

Public Health

Public health risk associated with this option is the potential public exposure to the effluent during irrigation. Wind blown effluent from spray irrigation has been shown to transmit pathogens. Consequently, buffer zones surrounding the land application site would be required. The size of these buffers currently has not been determined. Det rmining factors would include evaluation of wind velocity, residential dwelling locations during the final design stage.

Health risks would be greatly reduced in this option since the City of Greeley would maintain control of the effluent during reuse and discharge. Some risks would be associated with the farms during operations. Education and special precautions should minimize these risks.

Odor

Odor impacts from treatment and storage will be the same as those described under Alternative 2. The potential for odors at the land application site should be minimal providing the soil is maintained in an aerobic condition. Farming practices of discing, plowing, etc. should provide odor free conditions in the soil.

Visual

Visual features and associated impacts of the treatment and reservoir facility will be the same as those discussed under Alternative 2. The conversion of dry land to irrigated agriculture should not produce any visual impacts due to the agricultural character of the surrounding land.

Agriculture

This option will convert between 2,000 and 3,000 acres of historically dry land to irrigated land. This is in keeping with EPA's agricultural land policy of preserving agricultural land. At this time, the crops that would be cultivated have not been determined. Corn and alfalfa are the most probable crops that would be grown.

Both crops have high annual water requirements and their nutrient uptakes should remove most of the wastewater nutrients and there is a local market. A third crop option would be reed canarygrass. Reed canarygrass has been irrigated with applications of water of two inches per week (in/wk) which is comparable to corn (2.5 in/wk) but has the benefit of a longer irrigation period. Reed canarygrass can be irrigated as long as the soil will take water. It is also a nutrient demanding crop. Local markets have not been identified at this time which may be a major drawback to this crop.

The buildup of toxic or hazardous materials in soil crops or livestock has a minimal potential for occurring. Concentrations of these parameters in domestic wastewater have not proven detrimental in similar land application projects. The implementation and enforcement of pre-treatment requirements on industries along with detention/storage of the wastewater prior to application will minimize toxic materials buildup at the application site. It will be necessary to occasionally monitor the pH of the reservoir water to insure a more basic condition. This basic condition will reduce the tendency toward solubility of metals which occurs with more acidic conditions.

No impacts to livestock as a result of being feed silage or grain produced under this system are expected.

Land Use

This alternative has the most significant land use impacts. Between 2,000 and 3,000 acres would change from rangeland to cropland. A use/value assessment was conducted on the study area to determine the productive value of the land. This model was utilized to avoid values associated with speculative influences. Consequently, only values associated with the land's productive capabilities are shown. (See Appendix D for details of this procedure.)

Every soil in the study area has been grouped into land capability classes by the Soil Conservation Service. Land capability classes are soil groupings of both arable and non-arable soils which are classified according to their potentialities and limitations. Of the eight classifications, five were found in the study area. These classes were broken down into four soil groupings because classes IV and VI were quite similar regarding the needs of this study. Group A were the highest quality soils such as Ascalon loam while D soils were of least quality (such as Bankard sandy loam). A productive value was then assigned to each.

A best value-worst value case was established for each soil grouping. This was necessary because it was impossible to determine the exact amount of acreage under irrigation by soil type. Best value-worst value establishes extreme parameters. Actual value would fall in between these parameters.

Exhibits 19 and 20 show the study area by soil groupings without and with irrigation. Irrigation alters the capability class of some soil types. With the use/value assessment, this alteration can be measured by productive value. The change of classes occurs between two soil groupings; D to C and D to B. Table 13 shows the value per acre of soil groupings both best case-worst case.

TABLE 13

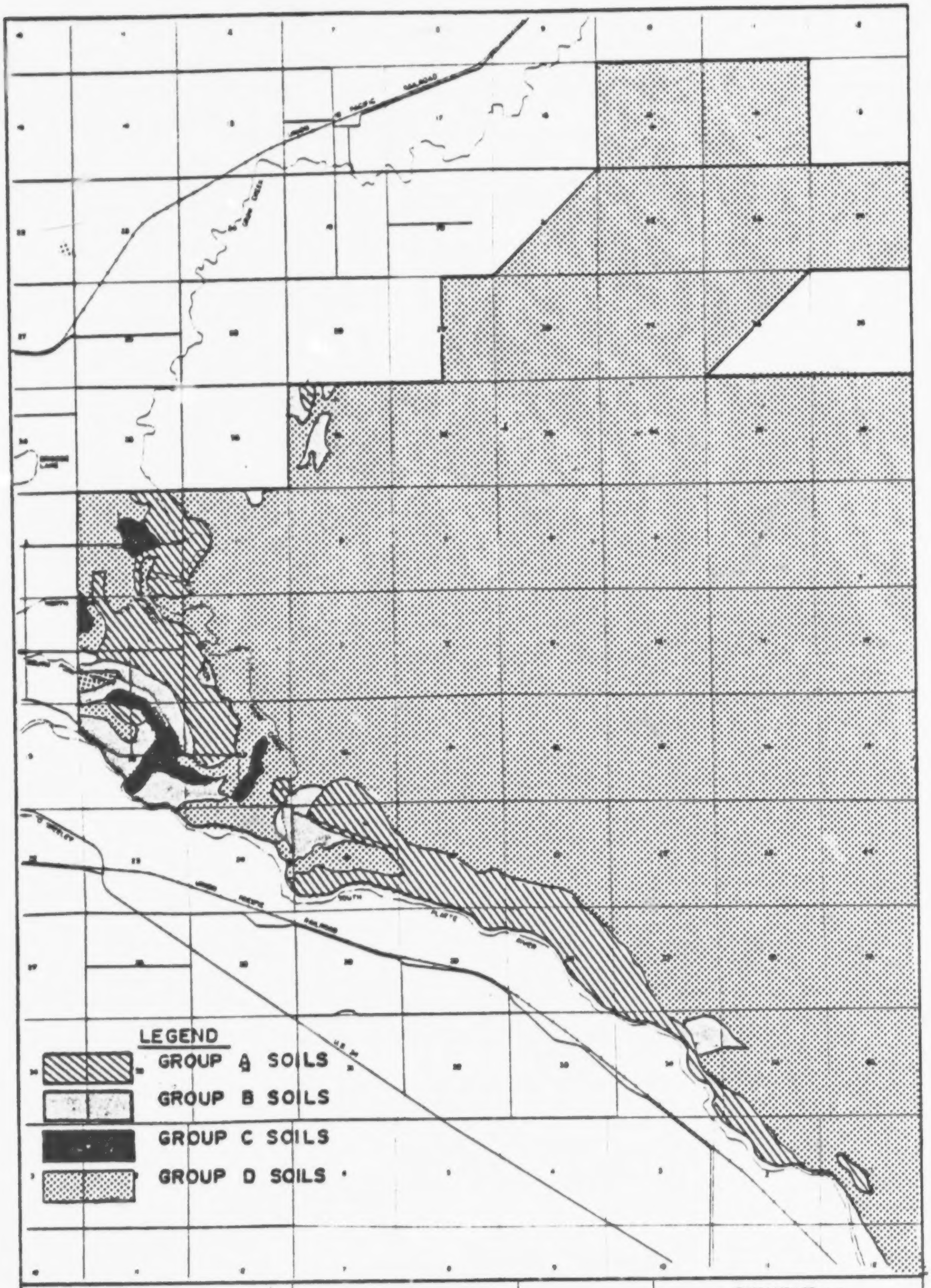
Value Per Acre for Designated Soil Groups

	Best Case		Worst Case
A	$1,360.26	A	$ 364.98
B	1,174.77	B	315.21
C	618.30	C	165.90
D	61.83	D	16.59

There are three ways of measuring the effects of irrigation. First, there is a comparison of values within the worst case classification. Groupings changing from D to C have an increase of value per acre of $149.31. Groupings D to B increase $298.62. Best case comparisons are a second measurement. Comparisons within the best case are $556.47 and $1,112.94 value per acre respectively. Finally, assuming the non-irrigated land (not being used agriculturally) is worst case and when irrigated, it becomes best case (in that the treated effluent is very high in nutrient value), the change in values would be D to C $601.71 and D to B $1,158.18.

Irrigation in the study area from the land application alternative will have a positive effect on land use. This area is not looked on as an area of commercial or residential development. Production value of the land in the study area would increase as well as the generation of crop revenue. There would be little detrimental long term land use impacts on adjacent farmland (see Appendix E on land value impact).

There are four primary institutional arrangements for ownership/operation in this alternative. These are presented in Table 14. All four alternatives would maintain the land on public tax rolls in order to eliminate the possibility of tax revenue loss.

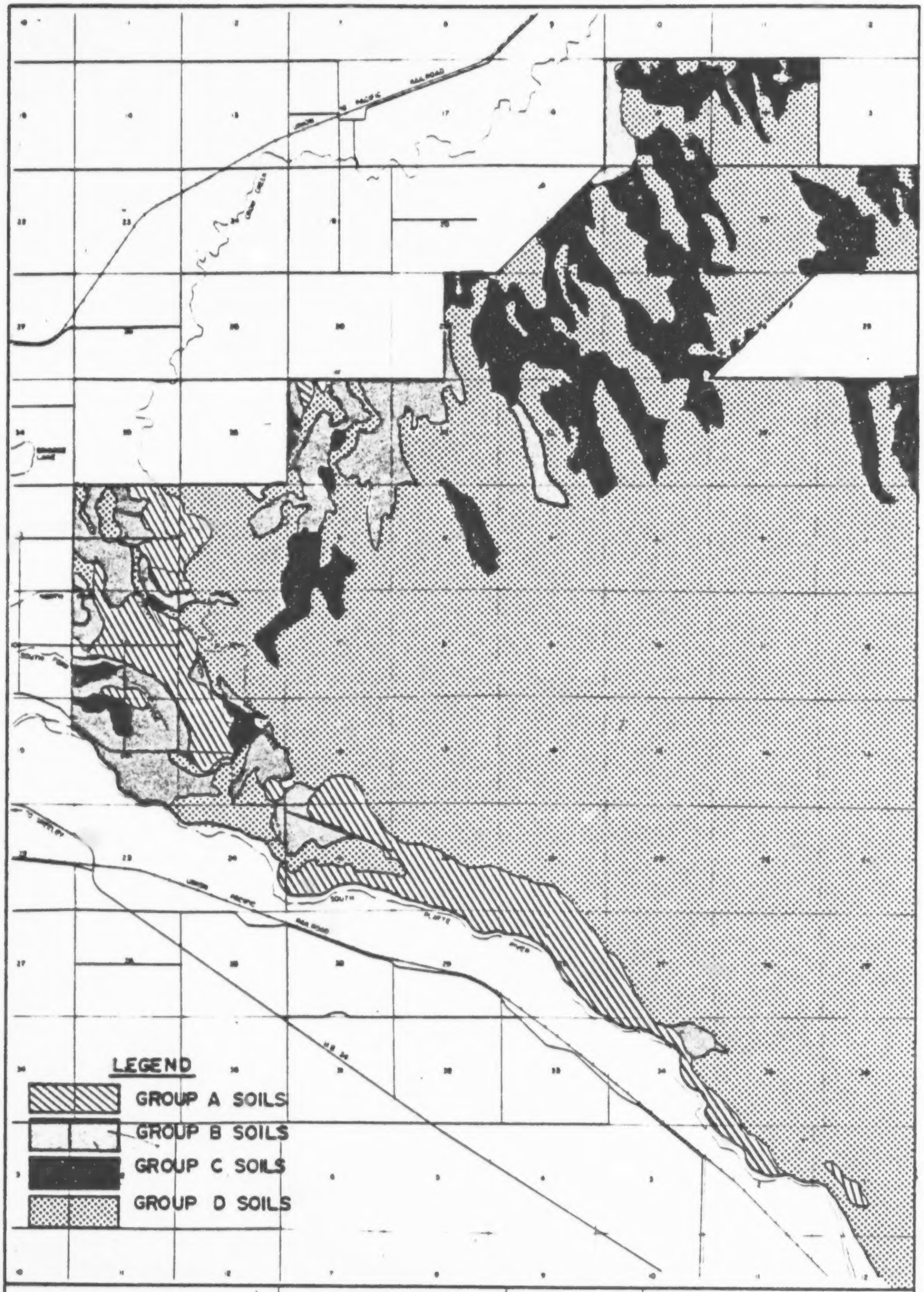

LEGEND
GROUP A SOILS
GROUP B SOILS
GROUP C SOILS
GROUP D SOILS
UNION PACIFIC RAILROAD
SOUTH PLATTE RIVER
U.S. 34

URS [illegible]
ENGINEERS ARCHITECTS PLANNERS

MAP TAKEN FROM
GREELEY 201 STUDY
BY ARIX CORP

EXHIBIT 19

LAND CAPABILITIES WITHOUT IRRIGATION


UNION PACIFIC RAILROAD
CROW CREEK
TO GREELEY
UNION PACIFIC RAILROAD
SOUTH PLATTE RIVER
US 34
LEGEND
GROUP A SOILS
GROUP B SOILS
GROUP C SOILS
GROUP D SOILS

URS [illegible] E. EXPOSITION AVE.
DENVER, COLO. [illegible]
AREA CODE 303 [illegible]
ENGINEERS ARCHITECTS PLANNERS

MAP TAKEN FROM
GREELEY 201 STUDY
BY ARIX CORP

EXHIBIT 20

LAND CAPABILITIES WITH IRRIGATION

TABLE 14

OWNERSHIP		OPERATIONS	
Pretreatment Facilities	Farm Lands	Pretreatment Facilities	Farming Operations
1. City	City	City	City
2. City	Present Owners	City	Contractor
3. City	Lease	City	Landowner
4. City	Lease with Purchase Option	City	Tenant

Costs

The high-low cost estimates for this alternative are $37,424,800 and $32,272,300 respectively. All costs are in 1979 dollars.

ALTERNATIVE 9 - 4-Day Detention Lagoon, Reservoir Storage, Land Applications for Crop Production, Groundwater Collection, Discharge to Crow Creek

This alternative is identical to Alternatives 4 and 7 in treatment processes in the lagoons and reservoir, and identical to Alternative 8 in the land application and discharge facilities.

The significant difference between this alternative and Alternative 8 is operation of the lagoons and the function of the reservoir in the treatment process. The 4-day lagoons may require more frequent solids removal and would be more sensitive to system upsets. Consequently, the reliability of this alternative is considered lower in its ability to provide a consistent water quality for irrigation.

The impacts to surface water quality, groundwater quality, public health, and agriculture are the same as those discussed in Alternative 8. Visual and odor impacts are the same as those discussed under Alternatives 4 and 8. Land use impacts are the same as Alternative 8.

Costs

The high-low cost estimates for this alternative are $37,003,600 and $31,851,100 respectively. All costs are in 1979 dollars.

Subalternatives

The nine alternatives have five common components which themselves have various subalternatives. These are:

o	Sewer outfall (interceptor for consolidating wastewater)
Subalternative 1	Interceptor from southeast interceptor pump station to First Avenue (western routing)
Subalternative 2	Interceptor from First Avenue to Delta Following a northern routing plus southeast interceptor
Subalternative 3	Interceptor from First Avenue to Delta site following a southern routing plus the southeast interceptor.
o	Pretreatment
Subalternative 1	Bar screen at First Avenue plant
Subalternative 2	Bar screen and grit removal at First Avenue
Subalternative 3	Bar screen at Delta site
Subalternative 4	Bar screen and grit removal at Delta site
o	Pumping
Subalternative 1	First Avenue pump station
Subalternative 2	Delta site pump station
o	Transmission (Interceptor to treatment site)
Subalternative 1	Interceptor from First Avenue to east Study Area (single or dual line)
Subalternative 2	Interceptor from Delta site to east Study Area (single or dual line)
o	Storage Reservoir
Subalternative 1	Single cell reservoir
Subalternative 2	Two cell reservoir

Each subalternative for the components has beneficial and detrimental features. The majority of the consequences of selecting one component subalternative will be realized in operations and maintenance of the total system. The following describes the beneficial and detrimental features of the component's subalternatives.

Sewer Outfall

Subalternative 1	Interceptor from southeast interceptor pump station to First Avenue

Beneficial Features

- Preliminary routing follows existing roadway right-of-way, no private land required to consolidate

- Gravity flow reduces maintenance and energy requirements
- One line handles total ultimate flow of six mgd from southeast interceptor
- Limited potential for odors to develop in line because of short conveyance distance to central collection point
- Consolidates majority of Greeley's wastewater with construction of on line

Detrimental Features

- Disruption of local traffic during construction and maintenance
- New, large lift station to gravity flow line requires additional energy and maintenance
- Loss of useful life of existing lift station at end of southeast interceptor
- Conveyance of wastewater from Delta area not provided
- Line does not terminate at a proposed treatment site, additional line will be required, increasing costs and maintenance

Subalternative 2 Interceptor from First Avenue to Delta following a northern routing plus southeast interceptor

Beneficial Features

- Does not require new lift station on Southeast interceptor, existing lift station abandoned, reduces maintenance, improves reliability
- No lift station required on Northern link, improves maintenance and reliability, and reduces energy requirements
- Line terminates at proposed treatment site. Reduces cost and maintenance

Detrimental Features

- Preliminary routing requires acquisition of some private land
- Disruption of local traffic and private residences during construction and maintenance
- Northern interceptor conflicts with proposed recreational lake

- The length of interceptor increase the potential for odors to develop

Subalternative 3 Interceptor from First Avenue to Delta site following a southern routing plus the southeast interceptor

Beneficial Features

- Preliminary routing avoids private lands
- Provided wastewater collection to Delta area
- Terminates at alternative treatment site
- Abandon pump station on Southeast interceptor reduces maintenance and energy requirements, but new pump station on southern line offsets benefits

Detrimental Features

- Preliminary routing will disrupt local traffic during construction
- Lengthy interceptor increases potential for odors to develop

Pretreatment

Subalternative 1 Bar screen at First Avenue plant

Beneficial Features

- Removes solids prior to conveyance to treatment
- Maintenance and disposal of solids more convenient
- Provides flexibility in selections of conveyance options

Detrimental Features

- Does not remove grit which may create problems in conveyance of wastewater particularly in long interceptors with minimum slope. Grit also will increase wear and maintenance on pumps
- May not provide for any pretreatment of Southeast interceptor wastewater, depending on conveyance option

Subalternative 2 Bar screen and grit removal at First Avenue

Beneficial Features

- Same as Alternative 1 plus grit removal, eliminates grit from outfall lines and reduces maintenance and wear on pumps

Detrimental Features

- May not provide for any pretreatment of southeast interceptor waste, depending on conveyance option

Subalternative 3 Bar screen at Delta site

Beneficial Features

- Removes solids from both First Avenue and southeast wastewater
- Site is compatible with a treatment alternative

Detrimental Features

- Commits system to use Subalternative 2 or 3 outfall, reducing flexibility
- Potential odor emissions due to potential for odor generation in Subalternative 2 and 3 outfalls
- Potential increases for solids and grit accumulation in outfall lines thus increasing maintenance requirements
- Commits Delta site as pretreatment site, may decrease maintenance and disposal efficiencies
- Does not provide grit removal

Subalternative 4 Bar screen and grit removal at Delta site

Beneficial Features

- Removes solids and grit from both First Avenue and southeast wastewater
- Site is compatible with a treatment alternative

Detrimental Features

- Commits system to use Subalternative 2 or 3 outfall, reducing flexibility
- Commits Delta site as pretreatment site, may decrease maintenance and disposal efficiencies
- Potential increases for solids and grit accumulation in outfall lines thus increasing maintenance requirements
- Potential odor emissions due to potential for odor generation in Subalternative 2 and 3 outfalls

Pumping

Subalternative 1 First Avenue pump station

Beneficial Features

- Pumping is not required for all outfall options from this site
- Maintenance may be reduced due to short travel distance
- Energy requirements depend on transmission option selected

Detrimental Features

- None Identified

Subalternative 2 Delta site pump station

Beneficial Features

- Pumping required only if Delta treatment site not selected
- Energy requirements depend on transmission option to alternative treatment site

Detrimental Features

- Maintenance may increase due to increased travel distance
- Requires implementing Subalternative 2 or 3 outfall, reducing flexibility

Transmission - Transmission lines are not necessary in the Delta Site option.

Subalternative 1 Interceptor from First Avenue to east Study Area

Beneficial Features

- No additional river crossing required
- Provides transmission of First Avenue wastewater to proposed treatment site, would require conveying southeast wastewater to First Avenue pump station
- Two lines offer higher reliability

Detrimental Features

- Lengthy transmission line increases potential for odor generation
- Lengthy transmission line increases maintenance requirements
- If Subalternative 1 for pretreatment were implemented potential for accumulation of grit
- Two lines increase costs, both construction and maintenance
- Requires two pump stations at First Avenue and southeast terminus
- No treatment provided for Delta Area

Subalternative 2 Interceptor from Delta site to east Study Area

Beneficial features

- Provides conveyance of wastewater from First Avenue, southeast and Delta area to alternative treatment site
- Requires only one pump station from Delta site under certain outfall options
- Two lines offer higher reliability

Detrimental Features

- Requires river crossing
- Lengthy outfall and transmission lines increase potential for odor generation
- Lengthy transmission line increases maintenance requirements
- Two lines increase costs and maintenance
- Commits Delta site to be integral part of any treatment system

Reservoir - Storage reservoirs are integral components of the lagoon treatment alternatives

Subalternative 1 Single cell reservoir

Beneficial Features

- Provides storage during winter in land application and additional treatment

- Provides uniformity in water stored

Detrimental Features

- Potential for algal growth increasing suspended solids in effluent
- Operation and maintenance may be complicated should reservoir require emptying

Subalternative 2 Two Cell reservoir

Beneficial Features

- Provides storage during winter in land application and additional treatment
- Operation and maintenance likely to be more flexible

Detrimental Features

- Water quality in two cells likely to vary
- Potential for algal growth, increasing suspended solid in effluent

COORDINATION

Chronology of Events for EIS Supplement

8/30/79	Meeting between Environmental Protection Agency, URS Company, Engineering Science, and the City of Greeley
9/11/79	Meeting between URS Company, ARIX Corporation and the City of Greeley
9/25/79	Public meeting for the environmental impact statement
10/4/79	ARIX presentation to the Greeley Water Board
10/11/79	ARIX presentation to the Greeley Water Board (continued)
10/30/79	Initial Citizen's Advisory Committee (CAC) meeting
11/1/79	Second CAC meeting
11/7/79	Public Forum
11/28/79	Third CAC meeting
12/6/79	Northern Colorado Water Conservation District meeting
12/11/79	Coordinating meeting between City of Greeley, ARIX Corporation, Ara Dimersion (Musgegon Wastewater Land Application Manager)
12/11/79	ARIX Meeting with Gill area residents
12/12/79	Fourth CAC meeting

Greeley Public Meeting
September 25, 1979

An initial public meeting was held in Greeley, Colorado to discuss the framework for the supplemental environmental impact statement on the City of Greeley's 201 Wastewater Treatment Project. Formal presentations were given by Armando Balloffet, URS Company, Gary Windolph, Arix Corporation, and Darryl Alleman, Director of Water and Sewer, City of Greeley. Forty-one citizens attended.

After a presentation on the EIS process and project schedule by Mr. Balloffet, Mr. Windolph explained the technical ramifications of the project. He also gave a brief history of the overall project to date with the justifications of re-evaluating original alternatives and developing new ones. He emphasized that the process involves technology, engineering, planning, and public participation throughout the study in order to develop an optimal plan for Greeley.

Mr. Alleman spoke on the alternatives themselves and how they fit into the context of Greeley's needs. He explained the differences between aerobic and anaerobic systems and their adaptability to the project. Mr. Alleman presented two displays showing the new study area and the routing of the pipeline from a pump station at Delta site to the study area.

In response to this, a question was asked concerning why the pipeline was to follow the county road. Mr. Alleman explained that it presented the least difficulties for right-of-way and dealings with the County. This brought up a concern by some land owners over pipelines in their fields which they did not want. In addition, future plans could include Gill in the pipeline design and eventual hookup.

Mr. Alleman explained that the irrigation alternative would provide Greeley with revenue from crop production whereas with a mechanical facility, no expenditures could be recovered. There was a discussion on the potential for renting water and selling sludge from a mechanical facility. This was explained as not being cost effective. The project is concerned with meeting future needs as well as present ones. The initial capacity will be 12 million gallons daily (MGD) with a potential for increase to 32 MGD.

Mr. Farr, Chairman of the Water Board, made a follow-up presentation in support of public participation. He reiterated various aspects of the existing facilities and the need for the City to recognize short and long-term wastewater treatment needs for the next 25 to 50 years.

Mr. Balloffet gave some concluding remarks and directing further inquiries to himself at URS Company. Mr. Windolph announced that a facilities plan forum would take place in 30 - 40 days.

LW/jj/mg

MEMO

No. 18 Date November 27, 1979 File

To: Citizens Advisory Committee

From: Stephen P. Sugg, Water and Sewer Department

Subject: MINUTES OF CITIZENS ADVISORY COMMITTEE MEETING ON OCTOBER 30, 1979

In Attendance:

CITIZENS ADVISORY COMMITTEE MEMBERS

Elmer Jones
John Hall
Bill Crosier
Jim Whitmore
John M. Wheeler
Sam Sasaki
Vicki Ericson
Doug Sears
Dewey Marcy
Jack Larson
Victor Wolfe
Harvey Peppler
Gretchen Cutts

OTHERS

George Hovey, URS
Larry Walker, URS
Al Udine, Engineering Science
Paul Sealy, Engineering Science
Tom Jones, Engineering Science
Gary Windolph, ARIX
George Barber, ARIX
Darryl Alleman, City of Greeley
Steve Sugg, City of Greeley

1. This first meeting of the Citizens Advisory Committee started off with a slide presentation given by Darryl Alleman on the City of Greeley's Wastewater Treatment facilities (First Avenue and Lone Tree Plants); the Muskegon Land Treatment System; the Lubbock, Texas Land Treatment System; and the Mitchell, South Dakota Land Treatment System.

2. Doug Sears asked why the City doesn't abandon the Lone Tree Plant and hook it into the transmission line for treatment in the new study area. Darryl explained that the reasons are several: the Lone Tree Plant has not yet served its useful life, Monfort is still paying the amortization costs on the facility, and Monfort would have to pay ICR if they were included in a new wastewater treatment system for Greeley. Gary said that it would not be economical or practical to include the Lone Tree Plant into the new plant because the wastes are incompatible with the aerobic systems planned for the new facility.

3. Vicki Ericson asked how the land treatment sites were chosen. Darryl listed several factors: remoteness for odor control, uniform soils, cost of land, and water rights (all return flow will go back to Crow Creek).

4. Doug Sears asked about the total consumptive use from the land treatment alternative. Gary Windolph said they estimate around 8,000 acre feet per year of evaporation plus some use by the crops. He said we would have to augment the stream with 1,500-2,000 acre feet per year on the average. Darryl noted that the City can augment with No. 3 Ditch water.

5. Jim Whitmore expressed some concern about what measures will be taken to prevent the new wastewater plant from becoming overloaded. Gary stated that this will not become a problem because when the system reaches 80% capacity, the City is required to start the 201 planning process for a new facility. At 95% capacity, construction of a new facility must be complete.

6. Jack Larson, who lives near the proposed land treatment site, said he thinks the new plant should be built in town (Greeley). In building the plant east of Gill he says it's "out of sight, out of mind" to the City of Greeley. Darryl said that the only system that could be built in Greeley is a mechanical plant. The costs of a mechanical system are high and the treatment is undependable.

7. The Committee agreed to meet again on Thursday, November 1, to learn more about the alternatives in the ARIX report. At that meeting Gary Windolph will give the same presentation on the alternatives that he gave the Water Board.

SPS

SPS/ld

CITIZENS ADVISORY COMMITTEE

FOR THE

201 WASTEWATER MANAGEMENT PROJECT

1. Mr. Elmer Jones
1218 Fern Avenue
Greeley, Colorado 80631
PHONE: 353-1141

2. Mr. John Hall
Weld County Health Department
1516 Hospital Road
Greeley, Colorado 80631
PHONE: 353-0540

3. Mr. Bill Crosier
1010 9th Avenue
Greeley, Colorado 80631
PHONE: 356-1115

4. Mr. James Whitmore
25550 County Road 62-½
Greeley, Colorado 80631
PHONE: 353-9267

5. Mr. John M. Wheeler
2100 East 18th Street
Greeley, Colorado 80631
PHONE: 352-5065

6. Mr. Sam Sasaki
City of Greeley Planning Department
919 7th Street
Greeley, Colorado 80631
PHONE: 353-6123 ext. 245

7. Mr. Doug Sears
Sears and Company Realtors
1221 8th Avenue
Greeley, Colorado 80631
PHONE: 356-7700

8. Mr. Dewey R. Marcy
3430 13th Street
Greeley, Colorado 80631
PHONE: 356-7152

9. Mr. Jack Larson
Rural Route
Gill, Colorado 80624
PHONE: 352-2111

10. Mr. Victor Wolfe
30354 Weld Road 66
Gill, Colorado 80624
PHONE: 352-9436

11. Mr. Harvey Peppler
Rural Route
Gill, Colorado 80624
PHONE: 352-9182

12. Mrs. Vicki Ericson
Central Bank of Greeley
P.O. Box X
Greeley, Colorado 80632
PHONE: 352-7030

13. Mrs. Gretchen Cutts
2336 Sunset Lane
Greeley, Colorado 80631
PHONE: 353-8373

DATE: November 1, 1979

TO: Citizens'Advisory Committee for the 201 Wastewater Management Project.

FROM: G. Hovey and J. Fitzpatrick, URS Company

RE: Minutes from Gary Windolphs presentation to the Citizens' Advisory Committee regarding the proposed wastewater treatment facilities.

In attendance at this meeting were the following members from the Citizens' Advisory Committee; James Whitmore, John Wheller, Sam Sasaki, Jack Larson, Victor Wolfe, Harvey Peppler, Vicki Ericson and Gretchen Cutts. Others in attendance were, Rhiny Leffler, DEPA: Steve Sugg, City of Greeley; Paul Seeley, Engineering - Science; Gary Windolph and George Barber, ARIX; and George Hovey and Jamie Fitzpatrick, URS Company.

Gary Windolphs presentation on the Wastewater Treatment facilities covered the following areas; the alternatives how they were constructed and put together, cost estimates and, the advantages and disadvantages of each alternative.

Windolph began by describing the components of each of the 4 alternatives which are so numerous that he said there were possibly 90 different ways that the system could be coordinated. He said that costs are an important factor here in that all capital costs, contingencies and operating and maintenance costs have to be evaluated for each alternative.

Windolph said that the first system, the "Delta" Mechanical Plant, would be served by either of two alternatives; the north gravity line or the south line. In a comparison of costs the gravity line was shown to be the cheapest for this system.

James Whitmore wanted to know why the costs were presented twice, once with inflation and once without. Windolph explained that it was a government requirement.

The question was brought up as to how ARIX determined what area should be evaluated for the irrigation system. Windolph said that several revisions were required to find a final area and that the following factors weighed heavily in that decision; large land ownership, suitable soil characteristics, and consideration of water rights.

In regards to the treatment and discharge to Crow Creek, Windolph said that if there was no construction at the Delta site then the City could pump from the present First Avenue site. The advantages here would be lower capital costs but, operation and maintenance costs would be greater than those that might be experienced at the proposed Delta plant.

Two options are available for pumping to the lagoon and irrigation sites. Either the wastewater can be screened and the grit removed before it is pumped from the Delta or First Avenue plants, or it can be just screened and then pumped to the lagoon area. The Advisory Committee expressed some concern over having these lines located through their fields. Windolph explained that the alignment as shown in Exhibits 14 and 15 were not sacred and that adjustments could be made.

Windolph then explained the two options for treatment; the 24 day lagoon and the 4 day lagoon.

Whitmore wanted to know if the effluent could be sent into Crow Creek immediately out of the lagoons under new standards that will be applicable in 1983. Windolph said that this was still an unknown.

Whitmore also questioned the fact that if the proposed system is so simple (as was indicated by Windolph) then why was it not employed several years ago? Windolph replied that at that time people favored the mechanical systems.

The odor problem was brought up by Jack Larson. Windolph indicated that any odors would probably be limited to the immediate area.

Larson then stated that if odor will not be a problem then why not locate the plant closer to the City. Windolph said that ARIX's proposed location maintains the option to use the effluent for irrigation purposes.

Steve Sugg also supported the new system saying that not only would it be better than the existing system at First Avenue, but that a 24 day system would be easier to maintain. He said that at present the City has a general lack of facilities to work with and that a new system is needed.

Several citizens then expressed concern over the City's method of dealing with the odor problem at the existing treatment plant. Sugg said that the City was doing its best to alleviate the problem.

Windolph then discussed the 4 day treatment alternative explaining that after the 4 day period the effluent would then be discharged into a reservoir which would allow for material treatment. The advantages of this system over the 24 day lagoon is that there would be better control of water and water rights and that it would require a smaller land area.

Whitmore questioned what would happen to the system if a power failure occured. Windolph responded saying the system would have a built in alternative power source to deal with such a situation.

A disadvantage of the 4 day system over the 24 day system would be that it will require a more frequent sludge removal schedule.

In regards to costs, Windolph indicated that a 24 day lagoon would be cheaper to build than the 4 day because of additional costs associated with the reservoir construction necessary under the 4 day system.

Under the Land Application System Windolph said that either a 24 day or a 4 day lagoon could be used but that each would require a connecting storage reservoir. He then discussed the potential reservoir sites based on existing terrain. Here he referred to Exhibit 19 of the ARIX report which shows all the potential sites and the site that they (ARIX) determined to be most suitable.

Whitmore, Larson and various other members voiced some disagreement with ARIX's choice saying that they felt that site #4 would be more suitable.

In regards to irrigation Windolph said that soil types are not uniform in this area and so the location of the irrigators is not necessarily fixed. Underground piping to direct some of the water flow may be required.

Larson and Whitmore said that they thought ARIX's figures on crop revenues for the proposed irrigated areas were too high. Larson felt that there might be a possible drop in the value of some of the farm land if too much water was applied. He said that some of the fields could not hold as much water as ARIX proposed using. Windolph answered that the amount of water to be used was not a fixed figure and that, furthermore, numerous tests had been completed on soil permeability that showed most of the study area to be very suitable to the proposed irrigation program.

In a final note, Windolph reemphasized the fact that everyone should keep in mind that what is being proposed first is a wastewater system and that the irrigation function is only an option of this system.

JF:cdh

Citizen's Advisory Committee
Meeting #3, November 28, 1979

In Attendance:

Citizen's Advisory Committee

John Hall
John Wheeler
Sam Sasaki
Doug Sears
Jack Larson
Victor Wolfe
Harvey Peppler
Gretchen Cutts

URS Co.	Engineering Science	ARIX Corp.	City of Greeley
George Hovey	Allan Udine	Gary Windolph	Darryl Alleman
Larry Walker	Paul Seeley	George Barber	Steve Sugg

1. The meeting began with a presentation on the Environmental Impact Statement (EIS) by George Hovey. The nine alternatives found by URS and Engineering Science were briefly discussed.

2. A question was raised on why odors would emit from the alternatives. It was explained that a worst case analysis was made showing the degree of impact should the facilities malfunction or if high strength industrial wastes enter the system. John Hall clarified state regulations for violations of odor standards.

3. The effect on market value of the City growing corn was discussed. URS explained that their studies indicate a significant impact on local market value of corn if the city sold their crop at harvest time. The way to mitigate this is for the city to store their corn until after January 1, when the Greeley region imports corn for the feed lots. Alfalfa is imported all year round while there would be little effect on local market conditions with reed canary grass.

4. Darryl Alleman asked about the EIS timetable. It was explained that EPA is reviewing the preliminary draft. Upon completion of that, revisions will be made and the draft will be published in the Federal Register as a matter of public record. Thirty days from that date, a public hearing may be held. After the public hearing, the Final EIS will be prepared with a prefered alternative. It is anticipated that the public hearing will be held in mid-January.

5. Gretchen Cutts asked about staging the construction of the project with the possibility of adding the land application system when tertiary treatment becomes mandatory. Three constraints were discussed; 1) inflated costs, 2) land availability, and 3) federal funding.

6. The discussion turned to Gary Windolph on alternative reservoir sites. ARIX looked at site #4 as the reservoir site with the irrigation facilities remaining where originally proposed. ARIX determined an additional expenditure of 14 million with $13.5 million in capital costs and approximately $500,000 for increased operation and maintenance.

7. Doug Sears raised the possibility of smaller MGD facilities west of Greeley. This was felt to be impracticable for several reasons. Previous studies found that smaller plants west of Greeley would not be cost effective. Three sets of employees would be needed. If standards were raised to a tertiary level, upgrading three facilities would be very expensive. Land application is not feasible due to land acquisition costs.

8. Jack Larson was concerned about the bedrock. He feels it is pervious. Gary Windolph responded that he didn't think it was, but if it were, wells and pumps could be added to control seepage. A lengthy discussion on drainage characteristics followed.

9. Darryl Alleman concluded the meeting with a review of the public forum.

10. The citizens from Gill agreed to meet with Gary Windolph for a detailed discussion on their concerns with the project and ARIX's reasons for site selection.

Citizen's Advisory Committee
Meeting #4, December 12, 1979

Submitted by: Larry Walker, URS Company

In Attendance:

Citizen's Advisory Committee

Elmer Jones
John Hall
Bill Crosier
James Whitmore
John Wheeler
Jack Larson
Victor Wolfe
Vicki Ericson

URS Company	Engineering Science	ARIX Corp.	City of Greeley
George Hovey	Allan Udin	Gary Windolph	Steve Sugg
Larry Walker	Paul Seeley	George Barber	Pete Morrell
			Ara Dimersion (guest)

1) Gary Windolph began the meeting by handing out a composite of pros and cons for the four major alternatives. Discussion centered on this handout as the CAC gave their observations.

2) A question was raised on the costs for land application. It was explained that the land needed for producing crops was not figured in the cost total.

3) Mention was made of the potential for the reservoirs providing a habitat for waterfowl and other wildlife. This would be a possibility. Ara Dimersion, who directs a land application system in Muskegon, Michigan, said that between the reservoir and corn fields, thousands of additional duck, geese, rabbit and deer have entered the area significantly increasing the hunting potential there.

4) A question was raised if the treatment lagoons were capable of handling industrial waste. Gary Windolph explained that this design of lagoon is flexible enough, however the Greeley system isn't designed to handle heavy industrial wastes like that produced at Monfort. The size of lagoon for Greeley would have to be greatly increased. The lagoons can handle variations in waste better than a mechanical facility.

5) Vicki Ericson asked if the questions raised at the public forum had been addressed. Gary Windolph explained that this was in process of being documented. All concerns expressed by the public at that forum will be presented to the Water Board.

6) The meeting concluded with a general discussion on reservoir sites. The Gill area residents would like to see the site moved to alternative reservoir #4. They stated if that were to occur, there would be no opposition to the project. They expressed confidence in the work done to date but emphasized again their concern over the location of the reservoir.

PUBLIC FORUM

ON

CITY OF GREELEY

WASTEWATER TREATMENT ALTERNATIVES

November 7, 1979

The following persons were in attendance:

NAME	ADDRESS	PHONE
J.K. and Virginia Harsh	906 East 20th, Greeley	353-1181
Eugene and Shirley Robb	2233 Hwy. 34 E, Greeley	352-8381
Margaret Crapps	1031 E. 16th, Greeley	353-4856
Connie Mueller	1019 E. 16th St., Greeley	352-3670
Milford E. Peterson	Route 1 Box 19, Gill	353-0583
Jonathan H. Pfeiffer	Route 1 Box 17, Gill	352-8455
Edith and Frank Williams, Jr.	2145 Hwy. 34 E, Greeley	352-2414
Al Harrington	2126 14th St., Greeley	352-3731
Sandra Sappington	27512 WCR 54-½, Kersey	353-9462
Charles L. Achziger	29358 Hwy. 37, Greeley	353-0021
Jim Whitmore	25550 62-½ Road, Greeley	353-9267
Glen Hanson (Platte Valley School District Re-7)	316 4th Street, Kersey	352-6168
Sarah Herbert	909 15th Street, Greeley	353-6564
Carl Nakagawa	29945 Road 38B, Kersey	352-0699
J. B. Wells	Gill	
Elmer Rothe	1851 26th Ave. Ct., Greeley	352-6409
Darwin Tomky (Bijou Irrigation)	Fort Morgan	867-5179
Paul Seeley (Engineering Science)		
Allan Udin (Engineering Science)		
John Gauthiere (City of Greeley)		353-6123
Steve Sugg (City of Greeley)		353-6123
Sue and Dana Sughroue	26899 C.R. 62-½, Greeley	353-4708
Harold and Barb Andrews	28847 Co. Rd. 62, Gill	353-0016
Mr. and Mrs. Claude T. Cecil		353-2798
Mr. and Mrs. Jacob Miller, Jr.	Route 1, Gill	352-1749
R. Perchlik	1721 13th Avenue	352-5420
Harold and Gladys Pfeif	25705 Hwy. 263, Greeley	356-1677
Stow L. Witwer	27401 Road 58-½, Greeley	352-6943
Dave Bates	32736 Rd. 50, Kersey	352-8831
John Nakagawa	29945 Road 38B, Kersey	352-0699
Dennis L. Wagner (Bijou Irrigation)	Route 1, Orchard	645-2546
Stewart and Helen Briscoe	27465 Weld Co. Rd 60-½, Greeley	352-8289
Dewey Marcy	1990 Hemlock, Greeley	356-3152
Harvey and Ella Peppler	Rt. 1 Box 68, Gill	352-9182
Vicki Ericson	1816 22nd St., Greeley	352-7030
Mr. and Mrs. Jake L. Miller	Rt. 1 Box 25, Gill	356-2498
John H. Wheeler	2100 E. 18th Street, Greeley	352-5065
Don Myers	2001 Hemlock	353-3195
Elmer H. Jones	1218 Fern	353-1141

NAME	ADDRESS	PHONE
Mr. and Mrs. Lee Miller	29532 WCR 64, Gill	352-1631
Bill Putnam	525 N. 35th Ave., Greeley	353-1393
John C. McKay	1214 16th St., Greeley	352-5575
Caroline Smith	2501 E. 18th St., Greeley	353-7606
Carroll Bishop	Road 68, Gill	352-8048
Bud Clemons	Route 1, Kersey	284-5320
Loretta Lofgren	Rt. 1 Box 20, Gill	353-0193
Mike Kupko	2860 15th Ave. Ct., Greeley	356-0457
Bill Kelly	1401 32nd Ave., Greeley	353-2514
Mr. and Mrs. Victor Wolfe	30354 W C Rd. 66, Gill	352-9436
Connie Winpegler	26890 WCR 61, Kersey	352-4782
Ed Meyer	29975 WCR 59, Greeley	352-7286
Joe Kutcher	Box 29, Gill	353-4941
Sam Sasaki (City of Greeley)	Civic Center, Greeley	353-6123
Mark and Donn Vornholt (Fairmeadows Land Company)	P.O. Box 836	352-3496
Fred Fangmeier	2717 E. 18th St., Greeley	356-2267
Linda Fangmeier	2717 E. 18th St., Greeley	356-2267
Jack Holman	28236 Co. Rd. 58-½, Greeley	352-9572
Frances Christensen	Kersey	771-6054
Catherine Mathews	3791 E. 18th St., Greeley	352-0632
Stow Witwer, Jr.	1854 12th Ave., Greeley	352-3161
Russell Lofgren	Rt. 1 Box 20, Gill	353-0193
Ken Muller	508-½ 9th Ave., Greeley	356-4333
Rich Peterson	31010 WCR 388, Kersey	352-6638

NAME	ADDRESS	PHONE
Electa Isakson	26248 Road 66, Greeley	352-1481
Gary Fortner	915 10th St., Greeley	356-4000
George E. Barber	1806 Montview Blvd. Greeley	353-2460
Rebecca L. Safarik	1610 12th St., Greeley	356-2020
Mr. and Mrs. Carroll Flack	29950 Hwy. 37	352-1824
Annemarie and Hans Bleiker	1020 Grand Avenue	(307)742-5941
Bill Folger	1607 14th Ave., Greeley	351-0067
John Given	1734 17th Ave., Greeley	356-7466
Bob Boekenkamp	3942 22nd St., Greeley	330-9388
David E. Bates	610 Cheyenne, Eaton	454-2524
IlaMae Larson	Rt. 1 Box 29-A, Gill	352-2111
Jack Larson	Rt. 1 Box 29-A, Gill	352-2111
Ramon C. Moore	1909 21st Ave. Ct., Greeley	352-8620
Don Miller	209 2nd St., Kersey	353-2607
John Hall	1516 Hospital Rd., Greeley	353-0540
Gary Sears	2145 Glenfair Dr., Greeley	356-7700
W. H. Webster	1850 26th Ave., Greeley	352-3356
Robert A. Ruyle	2101 24th St., Greeley	352-1643
Louise Kutcher	Gill	
Andrew Gurtner	1219 4th Ave., Greeley	352-5140

HANS BLEIKER

This is a Public Forum on Greeley's Wastewater Restudy. The study is being conducted by ARIX of Greeley for the City of Greeley. I am Hans Bleiker, my wife is out there signing people in. We in turn are advising ARIX and the City on how to do things like this, specifically on how to involve the public in a project that is potentially controversial. That is why we are here. I am the moderator for this forum here and my only role is to see that the purpose of the forum gets accomplished as well as possible. So I need to explain a little bit what the purpose of the forum is. The purpose as we see it, is that for once the public is heard. We are very much used to it that the professionals who do the research and the studies for public officials ... and that is necessary in this kind of project. But there is something to be said for the decision makers who have to choose among various alternatives and the people who do the research for it for them to listen to what the people have to say, how they react to it, the concerns they have and the problems they perceive, and so forth. And that is really the purpose of this forum here. I have to look at my notes here that I wrote down during supper or otherwise I'll ramble on too much. So I will ask you to keep this in mind that this is a little unusual because all of us are really used all the time to the fact that public officials are up here presenting something to us, and we're not going to do that tonight. I would ask you in fact to, that if you have a lot of questions that you use some other medium. It isn't that there's a question that can really be answered ... and other officials that they can readily answer, sure we can, but I think it will interfere with the real purpose that they listen ... so please keep that one in mind. The problem is to literally outline, as I see it, and I'm not an expert in this area of wastewater in general, and certainly not about Greeley's project. But as I understand it, it is a rather serious problem.

It isn't one that is going to go away, even though maybe there aren't very easy solutions around. The City of Greeley evidently will have to do something about its wastewater. I understand that the restudy is done on the understanding, on the belief that there might be some better solutions around than the one that has been officially adopted sometime back. And we are in that process of exploring what those solutions are. Among those solutions as I understand it, there are no perfect solutions, all of them have some drawbacks, some few weeks back we had some ideas of further solutions they need to consider as I understand no decision has to be made or can be made until, not only all the engineers are done with their work, but also until they have heard from the people as to how other problems that you can read into it and that you can see. I think one should recognize this is just one kind of project of a whole kind of project. It's very very small... to any of the solutions they come up with that of course we are stuck with whatever has been done before, because that wastewater is not going to go away. The roles of lay people, of citizens, of populations, institutions, groups, neighborhoods and so forth, the lay, the citizens in general in this project as we have ... to be used in the city it has replaced several roles. We think a couple of very important roles as far as I know the project has been carried ... One very important role is that everybody who's possibly affected by anything being proposed needs to know about it and they need to know about it thoroughly and as far as I know our engineers work on this project, have gone and sought out these people and said you are thinking about something, want you to know about it, you may not particularly like what we're doing, but you need to know, please, let's establish a dialogue and you tell us what ... we think it's absolutely necessary. We can't do very good planning work, engineering work, anything else unless you talk to the people.

Secondly, it's our assumption, it's not an assumption, it's an observation, anybody today who works on fairly complicated things knows that. And that is the observation of the engineers who can't think of everything. They're going to overlook something. You know certain problems that they ought to locate. You have ideas, sometimes you have very clever solutions that they did not think of. That's another role that we think citizens have to play in this kind of project, if we don't use you as a resource, we might wind up with a project that is less good than it could have been and nobody gains from that. There is a very similar project that we saw in Wyoming, I lived in Wyoming, I used to be a resident of Wyoming. A very similar project that that community went through a few years ago, a water pollution problem ... everyone overlooked one little detail. Now, years later there are millions of dollars that are wasted, the problem is worse, everyone tried so hard but they missed one little detail. If just somebody could have found that and surfaced that, that whole agony could have been saved. Just everybody is heartbroken over what has happened to the community, how sour, how bad things have gone. That's what we want to avoid. And this forum can contribute to that, if we can get you to speak about things that are on your mind, whether it's good about what you know they are doing or it's bad, or simply concerns that need to be brought out that just might keep us from making that kind of a mistake. ... I have footnotes made about this, even though that is our purpose, that people can accomplish through this forum. I have to admit this, you probably also know, it's very difficult to have a large public meeting and have very constructive thing happen, it really is difficult. Not impossible, but difficult. And if somebody here wants to sabotage this purpose, you probably can because it's far easier to sabotage this kind of thing than it is to really make it work.

I'm here to hope that something useful comes out of this but there's no guarantee that it will. I have, I'm essentially appealing to you to help us to do something constructive with this. To tell us what bothers you is also of concern. So what we need to hear is your concern, your comments, your reactions. It's not necessarily a popularity contest, cleaning up wastewater is not very popular. It's very expensive, nobody really likes this kind of thing. So we recognize that. You probably have more important things than just to say that I like it or I don't like it. Tell us why you like it, or what you don't like, and what bothers you. The engineers promise to follow every expression of concern, the research element, your response, not tonight, but to go back to their drawing boards to look into it and feel that every...and I have very confidence and belief that they really will. We are recording everything that is being said so that, you know, we will not lose what you are saying...I think you will be most effective by being as specific as you can. But chances are there are reasons why you don't like it, reasons why you like something. Try to get after those things. There are some ground rules that I am going to suggest. The sign-in sheets that I see, there are relatively few people who have definitely said that they are going to speak ... wrote down that you don't want to speak doesn't mean that you can't ... we hope that more people will speak than said that they will. So, since there's not a heck of a lot of people that said that they want to speak, I'm going to try to do it without a time limit. And instead, I'm going to ask you to simply be as brief and as concise as you can and not make a longer presentation than is absolutely necessary, rather than have some artificial time limit. I'd rather that everybody with something to say, say it and make it as brief as you can. If there's a particular point that somebody else has already made, please don't repeat it. Just simply say that you agree with that particular point. I ask you, I can't really ... you, but I appeal to you not to use this forum as a soap box. ... Please be considerate of other people's time as well. The important thing that's going on back home may be of concern, but don't use up your colleague's, your friend's time more than you have to. The order of speakers, I'm going to just read the names off the sheets of those who specifically said they want to speak in the order in which they signed in and then we'll go through the, those people in that order, too, that said that maybe they want to speak, again, looking at the order on the sheets, and after that, those people who have not necessarily said that they maybe even want to speak. If there are a lot of questions of the engineers or of the City, I think that is far more important because then you're right back to the normal public meetings in which ... give a presentation, and that's not the purpose... If it's absolutely necessary that something be answered I'm going to call on some of the ARIX people to answer them, but I'll try not to. Well, those are the ground rules that I would suggest. Besides the soap box problem that sometimes happens at meetings like this, there is another that you may be familiar with, it's called the red herring problem. The red herring is an institution that the English peasants invented in the middle ages, and the nobility ... through the countryside, they would sometimes release the fox and the hounds would chase after them. Then elegant ladies and gentlemen came on their horses... so what the peasants would do, ... out in the meadows once in a while, and of course the fox would circle around, the fox got away, the horses would arrive and it would be pandemonium ... they would enjoy this, this was their form of entertainment, and sometimes this happens all over again today in the twentieth century life, somebody asking a question, not for the purpose of asking the question, ... but for the same purpose of simply raising hell, for saying something that is simply going to take the whole meeting off on some tangent. I can't really stop you from doing that, but I would ask you that you please

refrain from doing that if you can. The first person to sign in as definitely wanting to give a presentation is Glen Hanson. If you'd just come up here and speak from the box up here.

GLEN HANSON

Thank you. My name is Glen Hanson and I'm Superintendent of Schools of the Platte Valley District located in Kersey, Colorado. The boundaries of our school district encompass the proposed areas for the Greeley's wastewater treatment facilities as presented in Alternatives 2, 3 and 4. The school district is not listed as an affected group nor was the Platte Valley Fire Protection District or the Galeton Fire District or the Aims Community College all of which are tax-supported entities ... only those agencies such as the City of Greeley assumes ownership of property, that property becomes tax-exempt. Herein lies the major concern of our school district. It is a long-range concern not necessarily a concern of just the immediate future. It is a concern for a lost opportunity. Why are we concerned about this? If either Alternative 2, 3 or 4 are selected it will have some effects. The first effect relates to the location and it is apparent in all three Alternatives presently I believe, I haven't checked this out, but I believe that agricultural land is assessed on a combination of productive value and market value. The assessment method, however, can change in the future so there is a need to be concerned. The locations of the lagoons would have a market value effect on the surrounding land. This will be true particularly if the facilities operate as odor free as the City of Greeley indicates that it is capable of operating. Skepticism enters in on the part of potential buyers based on the problem we have found with any lagoon waste treatment facility, and particularly if you are familiar with either of Greeley's present systems. Concern that even if the system is not presently operating properly is the City of Greeley firmly committed to its continued proper operation or will the increased load, population growth, the effects of inflation on the future budgets, and the turnover of personnel cause the system in the future to become more of a problem. I ask, is the City of Greeley committed to the proper operation and maintenance of the facility to the point that they will sign long-range assurance ... with substantial damage clauses and suits of operation clauses in them. If they are not willing to provide insurance clauses, then there must be some skepticism on their part and it is only natural for someone interested in purchasing the land in that area also to be skeptical. If the proposed system operates with problems similar to Greeley's two present systems, you cannot disagree that there will be an impact on the market value for the surrounding land. Even if the proposed facility is operated properly, the reputation comes with the community, not with the new facility. A concern which we should also consider is alternative three, crop application. Two areas of concern surface here. First is the possibility that the City of Greeley owns the land to be irrigated by the sanitary ... Again, the land, if owned by the City of Greeley would be taken off the tax rolls. Of even more concern in the future is the fact that with the application of water to the present dry land, the value of that land would increase substantially. Therefore those governmental agencies that are supported by taxes derived from that land stand to lose not only the present value of the land, but they'd miss the opportunity to benefit from increased values as a result of irrigation. The City of Greeley can accomplish their purpose and meet their needs by alternative three, crop application plan, leaving the land in private ownership. If Greeley sewage must be treated in that location which is not our first choice, this method would help offset some of the decreased land values previously mentioned. There is a concern about the City of Greeley going into competition with farmers in the area. Tax-supported governmental agencies exist for the purpose of providing service to

their constituents and not to be in competition with private industries. The governing board of the Platte Valley School District is interested in community impact studies that the City of Greeley is consulting...to the best of my knowledge I'm not aware thatthis kind of impact studies have been done. It would appear to me that with the proper planning, it would need to be looked at. Questions like this we need some information on. What will be the effect on... and total assessed evaluation of the school district in the Platte Valley RE7... about future zones of the greater Greeley area ... proposed facility which they have not thought into the future about increased capacity, then there is a real concern there. What is the potential impact on the Platte Valley area? How does that translate into student increase or decrease? And more importantly, the ability to support an educational program with an increase or decrease in student population? And, how would the location of the sewage treatment facility and its effect on the assessed value of the district relate to the mill levy necessary to support a quality education program.

HANS BLEIKER

Thank you very much. The next person, I'm not sure that I'm reading the name right, it's Stan or Stow Witwer.

STOW WITWER

My name is Stow Witwer Jr., unlike Glen Hanson I do not have a prepared speech. I'm not sure what I'm going to say, but I do agree with all his comments. I must indicate that this is a difficult subject for many of us to consider because of the history of that area, the present use of the area and the future of the area. I speak particularly on behalf of our family, my father, mother, sisters and children...We are concerned about the economic impact, and we're also concerned about the aesthetic or life quality impact of this operation. I must indicate that there are several concerns which I think kind of form a general concern ... And one is that I'm not certain that the integrity of the representations made by the City of Greeley ... I think that the people in the affected areas have deep concerns about whether or not the well-intended, well-meaning representations made by those who know can be relied upon as absolute because I believe that those of us without very long memories, remember representatives from Omaha and others speaking with you about the present lagoon systems of Greeley. That has been answered to me when indicating that that is an anaerobic system and this is not to be an anaerobic system. So that may very well be the case and I certainly hope that this system would be more acceptable to the surrounding community than the existing facility. But I think that the fact of the matter is that the representation will be questioned somewhat and will be viewed with skepticism. I think the second matter which I think needs to be considered and maybe addressed in a general sense is that we, the population, cannot particularly well answer specific scientific and technical data which is as complex as has been prepared and it certainly seems to be excellent material and well-prepared. I have some gut reactions to portions of it, some of which are favorable and some of which are not favorable, but I am unable to respond particularly well because I don't know which of the alternatives the city views with most favor. By the same token, the city wants to know the reactions of the affected people before they come to that conclusion but I point out that that is a somewhat troublesome dilemma because I don't know that anyone can say exactly what their concerns are until they know exactly what the proposal is...However, no matter what the proposal is, no matter how well it operates, I don't believe there are many people who are going to welcome it. I believe it is somewhat like an uninvited guest coming into your living room. You're not quite sure what to do with him and your first impulse might be to throw him out. It may be that you would try to make some accommodations and work that out, and it is that latter approach which I would intend to suggest might be most beneficial. I don't know because you see there are a number of uncertainties there. I would also indicate that the process itself does not lead to providing the absolute assurance that, that what we're saying this evening or any other time would be particularly meaningful in a decision-making process. It's curious to me that the plan at the Delta Site is changed because cost overrun, or reevaluation cost figures and the alternatives in the southeast of Gill area I believe all run somewhat higher than that. But there must be some other than cost considerations. Now I am advised that the reason for that is that it is now determined that the land application or variations of the land application system may be more suitable, but I have to say again for those of us who are not technically oriented, we have to view that with some concern and some skepticism because I think we're left to wonder whether or not the fact that we're few in number might be one of the reasons for those particular alternatives. I think what I'm trying to say in various ways is that we view this with great and abiding skepticism and concern. We are unable to state what the impact will be because, at least I am because I, I don't know which of the representations are absolute and which are going to be carried out. You indicated in opening of the situation that occurred in Wyoming where one factor was left out and it turned out to be a disastrous situation. From what I know about the situation right now, reasonable engineering advice indicates that this is a sound and good proposal and to the extent that it has been studied at this point, I am not in a position to argue. I think that it has going for it the idea that it cooperates with nature rather than going against the natural functions. On the other hand, because of the skepticism I have, and I don't know that I am unique in the skepticism, but because of that skepticism, I think it is absolutely imperative that the City of Greeley stand behind whatever is done, and I personally have communicated this to the City in a letter which I have written which basically states that we're unable to state whether or not we oppose this program. I don't know whether there are going to be engineering facts which will develop, which will develop, which will make it particularly objectionable, but I state number one that I have to start out with substantial opposition, but I have to also state that if the City of Greeley were to guarantee, or warrant or represent the effects of that operation on the impacted area, I think many minds would be relieved. I'm not talking about a release to the newspaper by the mayor or city manager, or city council. I'm talking about a binding obligation in some form which would perhaps involve the ingenuity and creativity on behalf of the City and the city attorney to come up with something that will in perpetuity and forever obligate the City to operate in a manner that does not adversely affect the area. If that's possible, in other words, if the engineering advice and if people look at it at the outset and say it looks reasonable, and it looks like it's going to work, and can start from that premise, and if the City will then underwrite that with a guarantee, then I think that the concerns that I have expressed would be less than very substantial. I would emphasize, however, that I am not talking about some loosely worded public relations document. I'm talking about something that would bite. I'm talking about something that would place a very severe financial responsibility on the City that if the operation is not successful, that they will, within some reasonable period of time correct that situation. If they don't correct that situation, they will cease operation. Now if the City is willing and if the City can legally enter into such assurance, I think that would be very helpful. If Greeley cannot enter into that ... of assurance, or if between now and the final product it appears that the engineering product does not look acceptable, then I must indicate that our opposition would be complete and substantial, and it would not be engaged in a forum such as this, it would be engaged in another form. I'm

not as comfortable speaking for groups as I am at the courthouse. I'm indicating that, that I can't over emphasize this to responsible officials that if in fact the thing works and you're willing to stand behind it, I think that's a very different thing, than asking the affected area to accept the gamble because I don't know how it is other than gamble because other than in a very limited number of places this is still very innovative. It may be that there will be government funding to support that because what I'm talking about in terms of assurance, perhaps it involves the City replacing the entire system if it doesn't work. And that may seem very onerous, but it seems rather simplistic to me that whoever makes the proposal and whoever makes the assurance should, like the rest of us in the private world, be obliged to stand behind it.

HANS BLEIKER

Thank you. Mark and Donn Vornholt.

DONN VORNHOLT

My name is Donn Vornholt, and I'm speaking on behalf of Fairmeadows Land Company. Hopefully I will ... We recognize that these facilities have to be built somewhere. Sacrifices have to be made. In viewing the various alternatives I would like to comment very briefly on each of them. First of all, the mechanical system at the Delta site. I have a great deal of sympathy for the people that live in the area. At the present time, they are struggling with the problems and effects of the airport. I've been down in that area several times, we cannot even carry on a conversation down there until the helicopters get through doing their thing. And now they add insult to injury, the alternative of the Delta Site has risen again. In the last instance there was vigorous opposition to it which I think was justified, and I think actually the site was turned down because not only the cost, but the opposition of the people in the area. To have this resurface again, it is a serious alternative, I'm sure the people in the area will oppose it just as vigorously as they did before. As a display of sensitivity for the people living in the area, I would like to see that alternative rejected. As far as alternative number two, discharge to Crow Creek ... as I understand it, this involves the, principally the Miller Farm located in the Gill or Barnesville area. It would involve an aerated lagoon system. The site is located from Thirty-fifth avenue in Greeley, a distance of fifteen miles. Now if we consider the growth west of Greeley is going to continue, let's assume that it will grow an additional five, perhaps ten ... That would mean in reality that we are transporting sewage quite a distance for treatment. From cost standpoint one would have to agree that it would be considerable. We are out in that area, we are neighbors of Mr. Miller, we would regret that his land be taken for an aerated lagoon system. It is irrigated land, and it's capable of good production. There is sufficient dry land in that area, that if this alternative were to be used, that this lagoon site could be put in a dry land area that would not have the environmental impact on those that would ... the Miller farm. In other words, what I'm saying is that if you're going to put this aerated lagoon site out in that area, put it in the dry land, at a site that is not going to be affecting people in that area environmentally, aesthetically, or etc. etc. Alternative number three, crop application, we are particularly concerned about this alternative, we are speaking of, I probably can't quote it accurately what ... twenty thousand, twenty acres of crop production of dryland would be put ... OK, two thousand ... we are very concerned about the economic impact on the people in the area. We have a very limited market for the crops grown. So far we have found few alternatives when we consider that our main crops are sugar beets, pinto beans, hay, and corn, either silage or chopped corn. Our only market, and we're grateful for it, is Monfort Kuner lot. Their quota is based on the number of cattle that they feed, and it is not a set number of acres each year. To give you an example, this year they contracted for the Kuner Lot, which a good number of acres in the Barnesville area were contracted. They contracted approximately seven thousand acres. Last year they contracted approximately sixty-five hundred. This was based on the fact that their lots were not full and so they had to carry over the silage and cut down their allotment, which means that that is that much less corn that we are able to sell to them. Now when we consider the fact that alternative three is talking about crop application to three thousand acres of land, if we are taking about sixty-five hundred acres and we are going to compete with the City directly or indirectly, that amounts to close to half of what Monfort is contracting to the area. We do not relish the prospect of competing with the City in the production of crops and the sale of them. Alternative number four, I'm confused on this because ... explained to me, but I couldn't quite hear exactly what he was saying, but they are talking about percolation through the ground and to go ahead and supplement underground water. This apparently is in further study and is not feasible, so I'm confused by alternative number four. When you get back to mileage consideration, when we consider pumping sewage fifteen to twenty miles, I would like to have the City consider, perhaps an alternate proposition of the area west of Greeley. The area east of Greeley, we are told, that it is capable in view of gravity flow. Now the area west of Greeley has both the Platte and the Poudre Rivers, and we have talked with, for example, in the areas of lagoon, with discharge back to Crow Creek and then back into the Poudre River. It would seem to me that the elevation of the area west of Greeley and the location of the Platte and Poudre Rivers would provide that gravity flow, and with the installation of aerated lagoons would be much more economical in that type of installation than transporting the sewage the distance fifteen or twenty miles east of Greeley. I think this should be certainly a serious consideration as an alternative. It is true, as previously mentioned, that sewage treatment facilities are not the most desirable thing in the world; however, we would like to share some of these facilities with the area west of Greeley. I think that's about all I have to say and we certainly appreciate the opportunity to speak to you this evening, and I think there are people considerations and as I just mentioned we would like to share some of these facilities such as the airport, sewers, feedlots, small industries, etc. with our neighbors to the west. Thank you.

HANS BLEIKER

Thank you ... George & Gary, if you need to say something because maybe a question that needs to be ... Get my attention. We have another, next on the list is another Stow Witwer.

STOW WITWER

I'll decline for the time being.

HANS BLEIKER

All right, OK, how about Bill Folger?

BILL FOLGER

I'm Bill Folger, President of the Greeley Audubon Society. I'd like to say that I speak for myself primarily, but I am sure that most of the members of the Society would agree with me that we would favor a crop distribution ... and tertiary as well as secondary treatment. I would think also that the site served by gravity, that west of town should also be considered.

HANS BLEIKER

Thank you. Jack Larson?

JACK LARSON

I didn't sign to speak.

HANS BLEIKER

In that case, I'm going to go to the people who said maybe they might speak, and let's see whether we have anybody take the bait on the subject. J.K. and Virginia Harsh, am I saying it right? Would you like to, ah...

____ HARSH

I have nothing ...

HANS BLEIKER

Eugene and Shirley Robb?

Mr. Robb

Pass for now.

HANS BLEIKER

OK. Please, don't everybody pass. Milford Peterson?

Mr. Peterson

I don't have anything to say.

HANS BLEIKER

In light of how well I'm doing at people turning me down, ah, I'm going to change the format and simply ask for the next person that would like to, rather than reading off a whole bunch of names. Who would like to speak next? Here we have somebody. And you are?

DARWIN TOMKY

I'm with Bijou Irrigation Company.

HANS BLEIKER

Give us your name so that the people who report will have it.

DARWIN TOMKY

My name is Darwin Tomky. I'm President of the Bijou Irrigation District.

We take our water out of the river a couple of miles east of Kersey. We use water on twenty-five thousand acres approximately, and if you take this two thousand acres of land and put it under irrigation, basically you'll be taking our water and we will highly object to it.

HANS BLEIKER

Next? Who's next? Yes? You want to take advantage of this. It's always the bureaucrats up front ... this is your chance.

CHARLES ACHZIGER

Charles Achziger, I think everything of concern has been said about the plant itself. I'm representing a few people that will be affected by the pipeline crossing their property. And we are opposed, if this happens, we are opposed to the pipeline crossing our property. We think there's a better alternative if it ... with our concern that the pipeline go through our property.

HANS BLEIKER

Would you speak on the better alternative that you had in mind?

CHARLES ACHZIGER

Well, as we see it, if they're going, if they are going to go out there they can go right out Eighth Street, or what we call Eighth Street, they make a jog off Eighth Street, go half a mile north, then cross about approximately two miles of farms, and then up the county road, and they can very well easily go straight out Eighth Street and not cross our farms.

HANS BLEIKER

I get it, OK, thank you. Who's next?

JOHN MCKAY

I'm John McKay. I'm very pleased to have this opportunity of presenting what I consider a perfect alternative, to offer the possible sewage disposal project. It seems that most people have the idea that their human waste is

not offensive, and it's all right to dump it in an area that they don't use. Now I have in mind a program that would take care of the sewage of every town and hamlet in this drainage area. The only thing that kind of bothers me, and I've been assured that that is not anything to worry about because they say that there's a possible way to treat sewage so that it's in a condition that can be used in fertilizer and water used after the treatment has occurred. Now there's an area of up to two thousand acres east of Brush that there isn't a house in miles of where this treatment plant can be placed. And the physical contour of this whole drainage area would allow this plant to be located in that area, and be fed by gravity pumping just a pipeline that would take the sewage, from just an example, Fort Collins, Loveland and Longmont and all those towns in that drainage area, and be transported in a pipeline to that area east of Brush. Now I'm sure that there's going to be lots of opposition to such a program as that, but when you take care of Greeley's sewage in itself, you still have all that other sewage in the Platte and Poudre River, and in reality, we're just taking care of Greeley's sewage. I've heard that the main opposition that would be is that you couldn't get the cooperation of the, these other towns. Well, I don't know that it's ever been tried, and I'm sure that a plan of this kind would be of such vital interest to the whole drainage area that it deserves consideration, and in signing off, I would like, before too much is made with other plans, I would like to furnish the transportation for the engineers to go down there, and just investigate this idea. Thank you.

HANS BLEIKER

Thank you. Who's next?

DAVID BATES

I'm David Bates, and I hope I'm not still a landowner out there, I think I'm released from that under a contract of sale, but it would be possible that I would again come in possession of some land in the area suggested for plans two, three, and four. First, is the planning and engineering to be compensated on a percentage basis of the cpst of the plant?

HANS BLEIKER

The answer is no. It's a fixed fee.

GARY WINDOLPH

At this time there is no contract signed of any of the alternatives.

DAVID BATES

What is traditional?

GARY WINDOLPH

Well, at the present time, EPA allows several different forms of contract. It does not allow percentage of construction cost. Generally, it's a negotiated lump sum or cost-based contract.

DAVID BATES

I would suspect that the cost rate might give us a little idea of who might be interested in the most expensive solution to the problem. Is there anybody here who has any confidence whatever that Greeley will operate an odorless plant? That's probably about the situation now. This plant is so desirable that everybody is anxious to get it as far away from Greeley as possible. And ... people on whom to blame. Nobody has suggested a properly operated mechanical plant ... adjacent to the present First Avenue or Second Avenue plant, whatever its name is. That might even keep the problem and solutions right where the problem began.

STOW WITWER

I'm Stow Witwer, Sr.. To me this is a very interesting meeting because as the

man in charge said, generally they have a few big shots up here and they tell us what's going to happen and we can take it or leave it. And then there's a big argument, and nobody gets anywhere. To me, it's a frightening situation, because it's a sewer problem. It isn't just for Greeley, it's worldwide, and as somebody suggested, we'd like to share it. We don't want to take it all on us, and if you're not interested to go out west, you can go south, Brush,... and I can only back up what my son said so much better than I can, that my feeling is that if they do come out there in our area, there's got to be not just a nice statement made by the mayor or some Greeley engineer, or George here. George has told me nice stories about what they are going to do. George and I are good friends, see, and he has a job with a good company, but this thing is for the ... to take a look at. I've been there for quite a while, I've been out there ... , I've got a couple of neighbors here that have been out there pretty near all my life, too, and we don't like to see a thing like that come into our area ... be no opposition from the people out east ... I see neighbors out there that I think would rise up and leave if necessary, ... but I don't think that's the attitude that you want to take. You want to work with it if you can. Now I see Ed Meyer sitting out there, my neighbor, and there's some engineers working right in front of his house that this group don't know anything about, and they're building the ... little beaver dam there you ever saw. And the thing about it ... if I was as sure that this fine engineering company would be as successful as that pair of beavers, I wouldn't fight it. But, I haven't talked to Ed since the visitors moved in, but apparently that's where the beavers feel is the best location, they come up the river, and it's about three miles that they have to travel up the river and they find this spot. Very few of us have beavers in the front yard. And they, three years ago did the same thing, it's a big spot with a nice lake, it might be a nice place for a lagoon, I don't know ... it seems to me that the, I don't think we out there, we don't want to have troubles ... but we know that there had better be some insurance or, I appreciate this type of meeting, I'm sorry that more of the folks out there didn't get up and tell the things, that some of them told me what they think, and I know that it isn't easy. What we must realize is that they've got a good engineering group and I think they're trying hard ... but we never have, as I told George, I said George, I can't make any statements, if I make any statements on the thing it'll be to my attorney, my son, but, I don't know which they want to do. Until I know some more about it, I'm not going to stick my neck out and get it chopped off ... he said that, because too often that happens. But I do want to compliment this group. I like what our school superintendent, Mr. Hanson had to say, and I appreciate the opportunity, see I've lived out there for going on seventy-seven years now, right in the same yard, but now people move around, but I hate to see this type of thing being talked about for out there, we can't stop that. I just want to encourage you that, don't anybody ... don't get too bothered about this thing until they lay something one way or the other, and made pretty plain what they're going to do, and then whatever you do, let's stick together on it. Thank you.

HANS BLEIKER

Who's next?

BILL WEBSTER

Thank you, I'm Bill Webster. I would second certainly, Stow Witwer's comments as to the neighbors we have in the area and certainly the competence that we would like to see from the city council, the city engineers and the engineers hired for this project that it will be, not certainly another East Lagoon type of project that came about, that so many of us live with now.

That was not in our minds a successful project, did not operate to specifications that it was claimed to be. And I think many of us are very much concerned about the way that this will be constructed and as to how well it will perform as far as problems that would be incurred by the people in the area. I might state the one specific thing, and I came in a few minutes late, but I did catch Chuck Achziger's comments on the route of the pipeline out there. Yesterday I spent about two hours on the works that ARIX Company has done, the engineers in the proposal, and I think certainly they've done an excellent job in laying out the alternate programs but what they do with the project once they get out there, and how it is to be handled. But I had a tough time figuring out how they went out there with it, and a detailed description of the transmission line to take the materials out there to be aerated and consumed in the lagoon system. My problem is ... the pipeline goes east of Greeley for approximately five miles then takes a half-mile jog north, and proceeds to cut through some of the best irrigated country in Weld County. Certainly I don't think this is an asset to those farms that are going to have to consume a large pipeline running through that area for a period of two miles before it again reaches the barrow pit of a county road and goes on to the area, the lagoons to be built. I can't in my mind, in studying it and talking to engineers, as well as constructors who hope to bid on this project ... they can't either see why the pipeline after running five miles in the barrow pit, is taken a half-mile north and proceeds to go through good irrigated farm. In their minds, and in mine too, I feel that the pipeline could stay in the barrow pit, the construction costs are less and there are less problems with easements and right-of-ways that have to be filed and costs thereof and they could stay in the seven-mile area completely out to the turn where it turns and goes north to Gill and then turns into the county road, approximately a mile north of that Gill road. This is in my mind is a simpler system, and I would entertain the comments from the engineering firm as to the reasons why they are doing this, if they hope to pick up the connection with the East Lagoon system which they would let folks do, it would be just as simple to take a pipeline from the East Lagoon system down to the main line, tie into it and go straight on east. I think that's all my comments. Thank you.

HANS BLEIKER

Somebody else has something else to say, I'm sure. Same opportunity...

BUD CLEMONS

I'm Bud Clemons, and I live out south of Kersey. I'm an employee of the Colo. State Land Board who happens to own some land in the area that will be affected possibly if, I don't recall which alternatives, three or four, I believe number four, effluent would be applied, a possibility it would be applied through some state land. There are a few things I would like to bring to your attention to something that I think a lot of communities are having to undergo all types of problems. I have personally been involved with state-owned lands, handling Denver's effluent, Limon's,Sterling's and several other communities that are in the process of ... problems. In fact, I laid down ... on an agency basis ... that are putting the pressure on the municipalities. Some of the things that the other communities are doing, Sterling is undertaking a situation very similar to Alternative #4, which would be to apply effluent to pasturelands, but they can't use irrigated land. This, I think, probably is one of the more viable applications where it does exist. Of course, it doesn't exist in some communities because they don't have that prerogative. One thing that hasn't been talked about, to my knowledge at least, is the possibility

that Limon ... are applying our plan because their plan is to apply effluent back to their municipal golf course. I am sure that most of you have read in the Greeley Tribune recently that the city had purchased some CBT water at $2,000 per acre foot, and I am sure they ... in excess of that. Perhaps rather than the city going out and buying additional water, maybe they should take this effluent and apply it back to the municipal golf course and various city parks they have, rather than going out and trying to purchase additional water, which will become more expensive as time goes on. That's all.

HANS BLEIKER

Thank you. Who is going to be next? If you have some ideas going around in your head you're not sure you want to bring up, the reason that we are doing this is very much that engineers are looking at the alternatives. They are going to report to the city. There is ... way that probable choosing among alternatives by appropriate decision-makers, they will have to choose some alternatives between the ones that they have developed .... They will look at your comments, at others, that will lead to that decision as they know how. It's just so tragic if two or three years later, some mistake pops up, and everybody says if only I had said something two years earlier. I had an idea but I didn't think it was important. Everybody has hindsight, we all get very smart with hindsight. Twenty-twenty hindsight. It turns out a lot of you have had ideas beforehand ... Anyone have any of those ideas, concerns, reactions, here we are.

JACK LARSON

My name is Jack Larson. I'm from the Barnesville area. I would be one of those more closely blessed if this goes through. I would like to remind everyone that it seems to be the general assumption that this crop application is the most popular idea, when in essence it's four plans, and we shouldn't forget that the Delta site should still be under consideration. If this is your feeling, I think we ought to push for it because I think that by moving it out that far they are going to use the theory of "out of sight, out of mind". If there is a problem, it won't be so readily available. If it's in here at the 1st Avenue location or some place close to town, they'll be more apt to take care of it. Thank you.

DAVID BATES

In order to avoid the correctness of hindsight and the error of foresight, I think we should begin concentrating on the fact that there are good odorless mechanical plants in operation. I know of no objection to Denver's operation in recent years. They certainly have a much larger amount of waste to dispose of in Denver, as long as I've known about it, which is almost four years, it's been an essentially odorless plant and discharges drinking water as an effluent. I don't see any reason to go into a risky venture when technology for a mechanical plant is well established.

HANS BLEIKER

For those who are recording, your name again?

David Bates

HANS BLEIKER

Who is next?

ELMER JONES

My name is Elmer Jones and I've been studying this in the Delta region, and I wish that I had these people on my side when I was studying out there. You people have not talked such extreme problems that we have. We have the Delta, but first of all, is the financial situation of the plant. Nobody here has talked about that. We have a plant being built in the Delta area, in 25-30 years from now, we will have to re-do it. And we are not thinking of plans for 50 or 100 years from now. This is the reason that this plant came up with the Delta, as people have not asked for. And so I can simplify it for you people. We know what the odor problem would be and it seems like we have always had the problem of Greeley putting something east of Greeley. But, on the other hand, when you look at a plant that is being used for 25-30 years, then having to re-do it again, that's a waste of taxpayers money. So why not let's do it right this time. Let's put it out and take care of our population in future years. And for the information that I would like to give, I can show the engineers where they can move the Delta pumping station to 8th Street Road which would probably sell and the land would be... the City could resell that and they could save $100,000 which could go towards the pipeline. And the other point that I would like to point out is that some of the sewer pumplines could be put out following the Platte River going to the pumping station which would be east of the airport. I am sorry that I can't be for the people out there, I know how you people feel but I think that the Delta people were in your spot and I think that its got to go someplace, but the financial portion of your tax dollar is more important than what we're talking about, putting it out there on a long-range plan. That's all. Thank you.

HANS BLEIKER

Who's next? I thought I had a volunteer there. Anybody else? ?????? Could I comment kind of on the reason the Bijou System would object? We don't have any idea how many acre feet of water you are discharging into the river right now, but this is how we get our irrigation water in Ft. Morgan, every bit that you put in the river. So when you put it out on that new land, we would lose it and I think by law, you wouldn't be allowed to do it in the first place, because these lands that are irrigation ...and this is one reason why

I brought it up. I was only notified the 5th, so we don't know what all your plans are.

GEORGE BARBER

We've hired George Palos from Ft. Collins to make the augmentation study ... for land application ... if selected, there would be augmentation and I would be more than happy to furnish you a copy of the report that gives some ballpark figures. We can't, of course, refine this until we know exactly what we are going ...

HANS BLEIKER

Somebody else?

??????

May I ask a question? Are any EPA people here tonight?

HANS BLEIKER

Is somebody here from U.S. EPA? Who would admit it? Maybe the question you had in mind maybe can be answered by somebody who is not with EPA.

???????

I didn't want to ask them a question, I just wanted to know if they was present.

HANS BLEIKER

I guess they are not here.

???????

There's another EPA hearing scheduled, isn't there?

GARY WINDOLPH

Yes, that would be the first part of December.

???????

Can I ask how this Gill site was selected? Why didn't they go farther east with it?

HANS BLEIKER

Who selected what Gill site?

???????

Apparently the city, I don't know.

HANS BLEIKER

George, do you know ... put him on the spot.

GARY WINDOLPH

Are you asking about the particular site or just the general area? ... What we are trying to do, for a land application system, we knew we had to have a fairly large land area, and the thinking was that we were looking for a dryland area, because if it was already irrigated it probably wouldn't work very well. Of course, there is a large area out there of dryland, a relatively few number of landowners to deal with. We were looking at such things as the water rights issue that was brought up, getting the return flows back into the river as quickly as possible, and that particular area satisfied that requirement, in that Crow Creek goes in above Riverside... Bijou Ditch. We were considering the farming operation, you have to have suitable soils, well-drained soils and a whole variety of things like that and also cost considerations. As much as we would like to go farther east another 5 or 10 miles, not to say that that couldn't be done, but sometimes you have to stop before you go beyond the dollars that are available. So a variety of things like that led us to the present site that is under study. There are also some more site specific things, the reservoir site on Jake Miller's land ... Mother Nature really put a nice location there to put a dam across that draw, and to give a pretty sizable storage reservoir at a reasonable cost. Just things like that, really. We just ended up there.

??????

Gary, I would like to ask you a question. Has therebeen any ... advising of what this might cost? Dr. Bates made a suggestion ... the site in Denver, what would it cost to increase the plant on 8th Street to take care of the thing in the manner like they do in Denver? Has that been bounced back and forth?

GARY WINDOLPH

Probably the best way to answer that is to look at the cost for a mechanical plant whether it be at the 1st Ave. site or the Delta site. The cost range is, we are looking at around 24-25 million dollars for a mechanical plant like Denver's at the Delta site. The land application alternative, which is the most expensive, ranges from 32 to 37 million in capital costs. I don't recall what the lagoon and the discharge in Crow Creek is, somewhere in between, in that range.

??????

So actually we'd pay less money to put one here, then.

GARY WINDOLPH

In first costs, in construction costs.

???????

Oh, alright, but the future then, is around the people that are going to use it, and they'll see it's taken care of, than rather out with us where we've got to have some guarantee it's going to be taken care of.

DARRYL ALLEMAN

I'm Darryl Alleman, Water & Sewer Director for the City. I'd like to add some comments made on that point. In our analysis, we're very conscious about operating costs for the City. We look at capital costs, what it costs to build it and we are also very concerned about what it costs to operate the facility, because we are concerned with annual dollars. The mechanical plant is the cheapest capital cost, but it is very expensive to operate a mechanical plant. It is very energy intensive, you need a lot more employees, the reliability is a lot less. We are very conscious of that. You go to the other end of the spectrum, and you have a lagoon system where there are crops grown. The annual operating costs of that are less than any of the other alternatives because there is a potential for the sale of the crops. There is a very significant possibility that you can lower your annual costs below any of the other alternatives, and in addition, you get a much, much higher level of treatment. You get a tertiary level of treatment, rather than a secondary level of treatment which is what we have now at 1st Avenue, and what Denver also has in their operation. I think anyone who has looked at the ...

HANS BLEIKER

My thought is ... the people who have something to say wouldn't have a chance of saying anything ... the opposite problems these people have other questions of the engineers. I just want to remark that if you have any questions, OK.

??????

In response to what he said I guess that's equal to the point that I brought up, and I appreciate the concern on capital costs and maintenance costs, but having it out in our area, we are very concerned that the City of Greeley is committed to enough maintenance and operation costs over the next 50 or 100 years, that it will be operated properly and that's where you come in with the insurances. If they are concerned about that now in operating a mechanical plant, is it such a concern that there will not be enough to properly operate it within the system.

??????

What do you do with the water in wintertime and after you saturate this ground out there to a point, it won't be good for farming and I don't think anyone is getting rich right now at farming ...

GARY WINDOLPH

The proposal is, we would store the effluent during the winter in a large storage reservoir that will hold 5,000 acre feet of storage, 600 surface acres, and then of course, it would be applied through the summer. Now, with the topography and geology ... being what it is in that area, it would require underdrains and the underdrains would be plugged in,...measuring, checking quality and releasing it to Crow Creek. With respect to getting rich raising corn, I don't know about that. I grew up on a farm and I remember the problems associated with it.

HANS BLEIKER

I thought you were going to say I got rich. Any other questions we can answer?

??????

In the operating cost...what happens if you looked into the operating cost of the equipment out there which does not discharge back into the Platte, including your cost of replacement water in the Platte. Now that isn't free.

HANS BLEIKER

Did everyone hear that question? I don't want to start it ... let's make sure that everyone hears the question.

GARY WINDOLPH

The question was, what about the cost of the water required ... the consumed water, the augmentation required, with respect to the consumptive use of the water on the project. It looks like that would be in the vicinity of 8,000 acre feet in consumptive use, out of about 13,400 acre feet that would be taken out to the site. So it's greater than 50%. Now with the reservoir, you have to consider also the calls on the river and what's happening, what the situation with the river is at any given time. You can't really predict precisely what's going to happen. The augmentation plan would have to take into account what has happened in that given year. Has it rained or floods ... downs or call on the river, whatever. We looked at 25 years of records on the river, rainfall, river flow records, call records, and so on and in the worst year we would have to replace 8,000 acre feet ... in the best year we would have to replace probably zero water. On the average for that 25 year period, it looks like around 1,500 to 2,000 acre feet of water. Now you can just sort of place your own value on what that 2,000 acre feet of water is really worth and what that would add to the cost of the system.

HANS BLEIKER

So your answer is yes, we do take that into account with the degree that we form costs in the operation. Other questions or comments?

??????

Mr. Alleman has got me very concerned with his statement that he brought up a little while ago. I don't think that I or anyone else intend to subsidize the citizens of Greeley by helping them operate their plant cheaper while the City of Greeley is selling in competition with me so the people of Greeley have a cheaper wastewater system and they put it in our area, plus we are going to subsidize them by being in competition on which it would be corn most likely, which is probably 70% in that area. This has me very concerned at this point when he comes out and makes a statement that that's how they want to cheapen their operating costs. How this is ... it is their problem and they should pay for their problem and we don't want to subsidize them. How am I correct or am I wrong?

GARY WINDOLPH

Sort of half and half. Now really what he said is what you heard. What he said, he may not have said enough, not that I'm trying to change your opinion, what you said is valid. What it really boils down to, and I think what Darryl was trying to say, is that a mechanical plant is more expensive to operate than a lagoon system, even forgetting the land application part of the area being used, the operation and maintenance cost is quite a bit less than a mechanical plant. Now on top of that, the farming operations, I think everyone has a different opinion on that, whether that would reduce or increase the operating cost. Maybe we couldn't make it farming, I don't know. But just the treatment aspect itself, the secondary treatment is cheaper in the long run ...

??????

It is certainly cheaper to knock off some operating costs with some income coming in versus any other kind of plant, but this is, I think, should be of great concern to the people and has me worried more so now than it's ever had.

GARY WINDOLPH

Another thing I want to say about that, is who would own and who would operate this is really an open question and I don't think it's any secret that the present plan shows the irrigated farming operation on Jack Wells' property and I've talked to Jack and I know he is not interested in selling the land and so on, and I don't think the City is particularly interested in going into the farming business. What I am really saying is that maybe we could end up with something like the system at Mitchell, South Dakota, where they treat it, Mitchell built it and provided the pivot sprinklers and everything, but the land remains in private farmland and it's just an agreement that in exchange for providing the water and pivots, the farmer agrees to take 2 or 3 feet of water or whatever through the year or so.

??????

Well, I just have to say that you're still missing my point somewhat. Irregardless of how it's done, if this is a cheaper method, the people in that area are going to subsidize the people in Greeley, one way or another. If this is a cheaper ... either way we are going to subsidize it. ... this is kind of on top of it, another department.

HANS BLEIKER

Do we have any other questions?

??????

Now is this, I'm not trying to get past Jack or anything, but if you're ... with him, how about me, I live a half mile from him. The value of my land is going to go down, about half at least.

GARY WINDOLPH

Now with respect to the use of that water in that area, I suppose water could go more places than just one. It wouldn't have to be just in one particular area. There are some problems with spreading it around, if you would want to take the wastewater, agree to take it, think it would be beneficial, it certainly would be looked at. We do have to keep close tabs on where that water is going, keep the control of it. That's one thing about it. Now we have the site now, it's a sloping site, an interceptor to hold the water, and everything's fairly well confined in a small area. So the Health Department officials and so on and surely the residents can be assured that they're not going to have "contaminants" all over the area. I think that's one of the problems of spreading it around.

??????

Do you intend to buy any more land than what it takes ...?

GARY WINDOLPH

Well, I don't know, it just sort of depends on how people feel about it and we're just kind of feeling our way into this, we don't know really.

HANS BLEIKER

OK, maybe because of the question and answers we've had so far, maybe we have some more people who according to the ground rules we started with, want to make some comment, observations, reactions, at this point.

GARY WINDOLPH

Why don't we take a break for a few minutes ...

HANS BLEIKER

OK, one thing that you may want to do is to single out Gary, George, ask them some specific questions that you feel they haven't answered, but why don't we take a break.

BREAK

HANS BLEIKER

I hope that there will be a few more people who would like to express particular views that they have, concerns that they have.

ANDREW GURTNER

My name is Andrew Gurtner. I have lived in the city of Greeley, on the east side around ... for the last forty years. I have served on the Board of Health for 6 years. One year I was Chairman of the Board. I was able to help the community here because they did have at that time, and still have, a sewer odor over on the east side. It has been somewhat improved in the testing ... and uses of how we go about it. But I do feel it is my concern for the people here to tell you that the City of Greeley needs a sewer plant and they need it real bad. They have been fighting this old system for the last 15 years. When I was Chairman of the Board of Health, they got some people out in Kansas City, Missouri for an International Convention on sewer systems all over the world. I was very much convinced that there is some possibility that sewer systems can be established without .. if they are far out. But from what I have found from that convention, that most of the plants went out

quite a ways from the cities and Sydney, Australia has a plant 70 miles out into the desert to eliminate the problems. They have the same type of sewer system Greeley has. It constantly broke down, they constantly had problems about the odors, so finally they raised enough money and built a 5 foot pipeline 70 miles out into the desert with lagoons whereby they switched from one section to another section and eliminated all their problems. They were even able to ... the engineers ... they even deliver the chicken ..., sewage, rubbish, papers, anything that floats, to pump out there and get rid of it from the city. I do feel that I think you people are concerned about the sewer being built east or west. I cannot blame you for being concerned because most places sewer systems are having an odor problem. But I think if they are properly arranged, properly handled, from what I have seen at Omaha, Nebraska, I have seen it in plants in the state of Colorado here that waste removal with its odor problems and I still don't understand why Greeley has such an enormous odor problem. Of course, the big question is because we have a sewer system here which is good enough for 20,000 to 25,000 people and we have 60,000 or 70,000 people here so it's completely overloaded. And I think it is necessary for the City of Greeley to take priority to do something about it immediately before the prices jump again and 37 million dollars is 137 million dollars, 4, 5, or 10 years from now. We should get a plant built today, tomorrow, the next day, so we can get some relief. I thank you.

HANS BLEIKER

Some other comments?

LOUISE KUTCHER

May I ask Mr. Gurtner a question? If the situation was reversed, would the City of Greeley take care of our sewage? I am in Gill and we have quite a problem out there, but I don't see the City of Greeley coming along and solving our problems. So therefore, I think the City of Greeley should solve their own problems. Put it out here next to the Country Club, build a $200,000 frame around it that makes it look like a house and they'll be satisfied.

ANDREW GURTNER

... but something needs to be done, and it's going to have to go somewhere.

LOUISE KUTCHER

Yes, but why does it have to fall east of Greeley?

ANDREW GURTNER

I do not say it has to go east, it maybe has to go west. But it has to go somewhere to relieve 70,000 people from this odor. They've got to do something.

LOUISE KUTCHER

Because we're the minority out there, we're going to get it.

ANDREW GURTNER

Well, you may be right.

LOUISE KUTCHER

I know I'm right.

ANDREW GURTNER

And I'm not here to criticize you, but it has to go somewhere to do something pretty soon.

LOUISE KUTCHER

Alright, then go south. South or west. Everything that's rotten goes out towards Gill.

ANDREW GURTNER

Well, I'm sorry that ... talk to the engineers.

HANS BLEIKER

Would you like to ...

LOUISE KUTCHER

No, I've said my part, because if I get up there I get mad.

HANS BLEIKER

For the benefit of the people recording, would you give your name?

LOUISE KUTCHER

Sure, I'm Louise Kutcher and I live right in the town of Gill.

MARK VORNHOLT

My name is Mark Vornholt and I'll try to bail Andy out a little bit there. I don't understand why consideration west of Greeley hasn't been talked about a little bit more, in that the future growth is headed west, the current growth is here now, and it seems to me that the cost analysis and what not, the feeder lines between our future growth and our existing growth would be cheaper in the long run if we centralized the site that way.

HANS BLEIKER

Fair enough, an honest way, consider something less. Some other suggestions, concerns. If I hear no others, I'll declare this Forum closed. I would invite you as individuals to take advantage of the fact that we have Gary Windolph and George Barber here and you may want to address a particular concern or question to them personally that they can answer personally. But if no one wants to come out and make a comment, I want to close the forum part.

DARRYL ALLEMAN

I have one comment, because we didn't respond to this woman's questions doesn't really mean that we don't have the concern, that I don't personally. I do have a great concern about the people in Gill. There was another comment about the economics. We realize that the economic situation in Weld County, particularly in agriculture, is very, very delicate. Our position is not to take advantage of anyone. We are going to do our very dead level best to try to have a system that would benefit everyone. I don't think projects are sound unless you can try to benefit everyone. Maybe that's not totally possible.

HANS BLEIKER

I think that's just another way of saying ... if there were some solutions that had no drawbacks, we wouldn't need to meet. These kinds of problems have ten times the drawbacks ... these kinds of solutions still have some drawbacks. We just want to make sure we understand these drawbacks ... that's the nature of it. Well, just because we're closing this Forum doesn't mean that the opportunity for expressing your concerns is finished. Any time you have any kind of concern or idea coming up, we invite you to get in touch with anybody in the City or particularly with the people at ARIX who work directly with George Barber and/or Gary Windolph. With that I would like to thank everybody for their participation and that's it.

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GLOSSARY

Activated Sludge Plant - A biological wastewater treatment facility in which a mixture of wastewater and activated sludge is agitated aerated. The activated sludge is subsequently separated from the treated wastewater (mixed liquid) by sedimentation and wasted or removed to the process as needed.

Aeration Basins - Tanks in an activated sludge plant where the raw or primary treated wastewater is mixed with activated sludge and agitated and aerated.

Aerobic - Requiring, or not destroyed by, the presence of free elemental oxygen.

Aerosol - A suspension of colloidal solid or liquid particles in air or gas, having small diameters ranging from 0.01 to 50 microns.

Ammonia - A chemical combination of hydrogen (H) and nitrogen (N) occurring extensively in nature (NH_3)

Anaerobic - Requiring, or not destroyed by, the absence of air or free elemental oxygen.

Aquifer - A geologic formation situated in the zone of saturation that has sufficient transmissibility to yield water to wells in usable quantities.

BOD - Biochemical oxygen demand, which is the quantity of oxygen used in the biochemical oxidation of organic matter in a specific time, at a specified temperature, and under specific conditions.

Bacteria, Coliform Group - Group of bacterial predominantly found in the intestines of man and animals which provides an indicator of the potential pathogenic bacteria in wastewater.

Chlorination - The application of chlorine to wastewater, generally for the purpose of disinfection, but frequently for accomplishing other biological or chemical results.

Clarification - See sedimentation

Coagulation - The destabilization and initial aggregation of colloidal and finely divided suspended matter by the addition of a floc-forming chemical or by biological processes.

Denitrification - The removal of nitrogen or nitrogen compounds from wastewater.

Detention Time - The theoretical time required to displace the contents of a treatment unit at a given rate of discharge (volume divided by the rate of discharge).

Digestors - A tank in which sludge is placed to permit digestion to occur. Digestion is the biological decomposition of organic matter in sludge, resulting in partial gasification, liquifacation, and mineralization.

Disinfection - The act of killing the larger portion of microorganisms in or on a substance with the probability that all the pathogenic bacteria are killed by the agent used.

Effluent - Wastewater, partially or completely treated, or in its natural state, flowing out of a reservoir, basin or treatment plant.

Filter - Device for removing solid or colloidal matter by passing wastewater through a medium that may be natural or artificial granular material, finely woven cloth, unglazed porcelian, specially prepared paper, or synthetic media.

Flocculation - The agglomeration of colloidal and finely divided suspended matter after coagulation by gentle stirring by either mechanical or hydraulic means.

Force Main - Pressure sewer line originating at a pump station.

Grit - The heavy suspended mineral matter in wastewater such as sand, gravel, and cinders.

Industrial Wastewater - The solid and liquid wastes from industrial processes, as distinct from domestic or sanitary wastes.

Infiltration - Groundwater which enters sewer lines through joints, porous walls or breaks.

Inflow - Direct extraneous connections to the sewer system such as roof drains and catch basins.

Influent - Wastewater, raw or partially treated, flowing into a reservoir, basin, treatment process, or treatment plant.

Interceptor - Larger diameter sewer lines which transport wastewater from smaller collector lines to a wastewater treatment facility.

Lagoon - A pond containing raw or partially treated wastewater in which aerobic or anaerobic stabilization occurs.

Land Application - Processs of applying treated wastewater to the land for further treatment or reuse as irrigation water.

mgd - Million gallons per day.

Microstrainer - A rotating filter utilizing a fine mesh screen.

Nitrification - The conversion of nitrogenous matter into nitrates by bacteria.

Nutrients - Inorganic substances involved in energy transfer and necessary for the growth and development of plants and animals.

Outfall - The point, location or structure where wastewater or drainage dischages from a sewer, draw or conduit into the treatment facility or receiving waters.

Pathogens - Bacterial that may cause disease in the host organism by their parasitic growth.

Permeability - Measure of the absorptive capacity of a substance.

Pretreatment - Preliminary treatment either at the wastewater source or just at the beginning of a complete wastewater treatment facility.

Primary treatment - The first major (sometimes the only) treatment in a sewage treatment plant, usually screening and sedimentation. Primary treated effluent is usually unacceptable for discharge.

Pump Station - A pumping location on a sewer line which forces the wastewater in a pressure sewer line to a higher elevation. Also, known as a lift station.

Salinity - Measure of the salt content in water.

Screw - A device with openings, generally of uniform size, used to remove solids in flowing wastewater and to prevent them from entering an intake or passing a given point in a conduit.

Secondary Treatment - The treatment of wastewater by biological means after primary treatment. Secondary treated wastewater is usually adequate for discharge unless the receiving waters require tertiary treatment.

Sedimentation - The process of deposition of suspended solid matter in wastewater by gravity separation. Also known as clarification.

Sewer - A pipe or conduit that carries wastewater or drainage water.

Short-circuiting - Direct flow through a treatment process without utilizing the entire detention time or process.

Sludge - The accumulated solids separated from wastewater. During processing by sedimentation, coagulation, or chemical treatment.

Soil Filtration - Utilizing soil as a filter medium.

Suspended Solids - Measure of the solids content of wastewater. It is the quantity of material deposited when a quantity of wastewater is filtered through an asbestos mat in a Gooch crucible.

Tertiary Treatment - Processes which treat effluent from secondary processes to remove or reduce nutrients, residual organics, and residual solids.

Trickling Filter - A filter consisting of a bed of coarse material over which wastewater is distributed or applied in drops, films, or spray from troughs, drippers, moving distributors, or fixed nozzles and through which it trickles to the underdrains, giving opportunity for the formation of zoogleal slimes on the media surfaces to clarify and oxidize the wastewater.

Wastewater - Combination of the liquid and water-carried wastes from residences, commercial buildings, industrial plants, and institutions, together with any groundwater, surface water, or storm water that me be present.

APPENDIX A

WATER QUALITY

Water Quality Criteria

Colorado Department of Health defines various uses as follows:

Surface waters suitable for a water supply are defined as:

> "Waters which after receiving approved disinfection such as simple chlorination of its equivalent or which after receiving standard treatment (defined as coagulation, flocculation, sedimentation, filtration and disinfection or its equivalent) will meet Colorado drinking water regulations and any revisions, amendments, or supplements thereto."

Recreational water is separated into Class I and Class II by the State of Colorado. These are defined as:

> Class I - "These surface waters are suitable or intended to become suitable for prolonged and intimate contact with the body or for recreational activities when the ingestion of small quantities of water is likely to occur. Such waters include but are not limited to those used for swimming."
>
> Class II - "These surface waters are suitable for recreational uses on or about the water which are not included in the Class I category".

Agricultural waters are defined as:

> "These waters are suitable or intended to become suitable for irrigation of crops usually grown in Colorado and which are not hazardous as drinking water for livestock."

Surface Water Quality

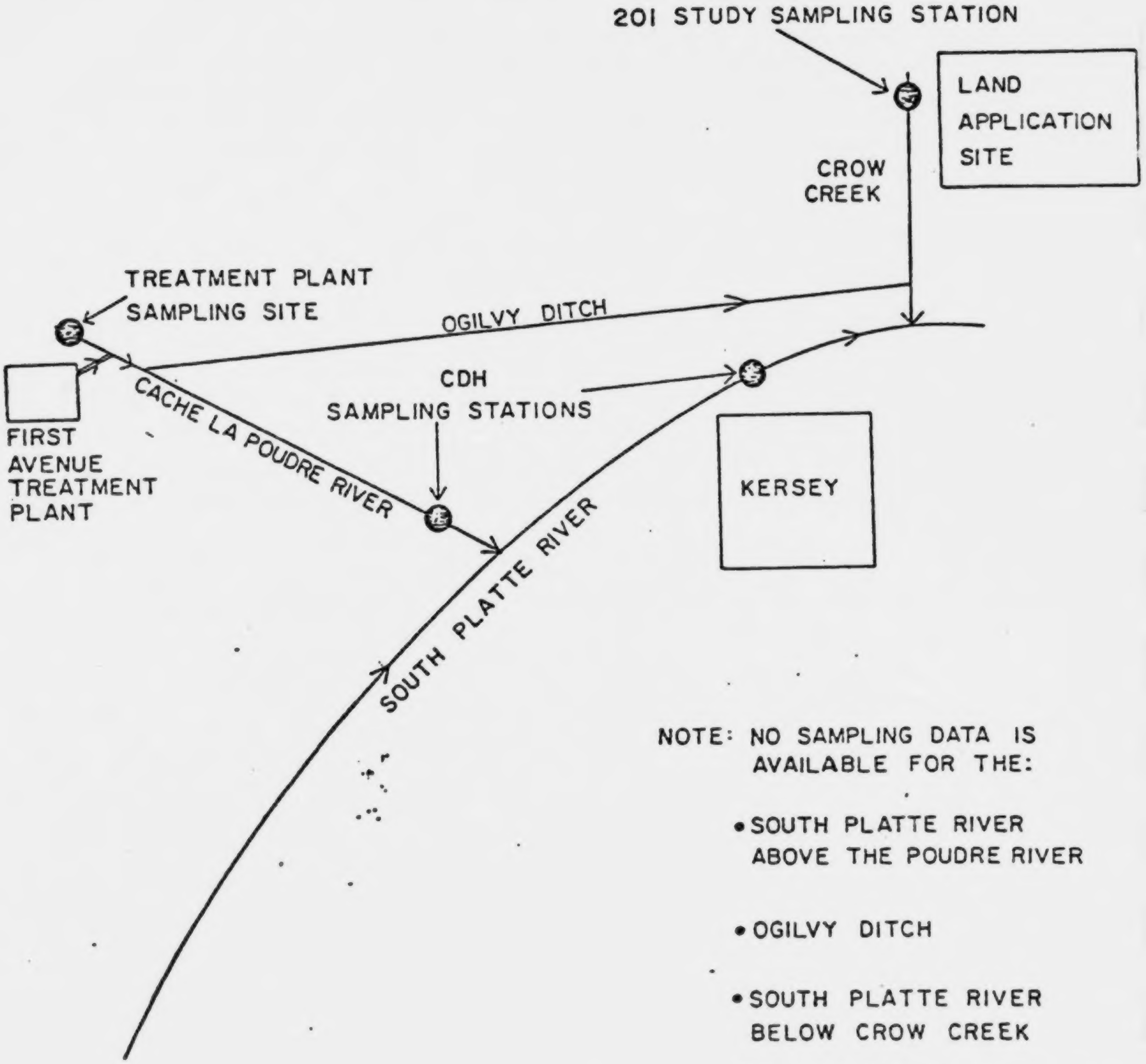
Water quality data have been monitored at four stations. These stations are located schematically in Exhibit A-1.

Water quality problems in the South Platte River are associated with the following parameters: fecal coliform, Ammonia and sulfate.

Fecal coliform bacteria are organisms that indicate the possible presence of disease-causing organisms such as pathogenic bacterial, viruses, worms, and protozoas. Fecal coliform is a more specific indicator of contamination from warm-blooded animals. Fecal coliform

EXHIBIT A-1

HYDROLOGIC SCHEMATIC OF THE GREELEY AREA


201 STUDY SAMPLING STATION
LAND APPLICATION SITE
CROW CREEK
TREATMENT PLANT SAMPLING SITE
OGILVY DITCH
CDH SAMPLING STATIONS
FIRST AVENUE TREATMENT PLANT
CACHE LA POUDRE RIVER
KERSEY
SOUTH PLATTE RIVER

NOTE: NO SAMPLING DATA IS AVAILABLE FOR THE:

- SOUTH PLATTE RIVER ABOVE THE POUDRE RIVER
- OGILVY DITCH
- SOUTH PLATTE RIVER BELOW CROW CREEK

CDH - Colorado Department of Health

SOURCE: ARIX, Wastewater Facilities Planning Report No. 1. Evaluation of Alternatives for Greeley, Colorado, August 1979, Volume 1, Main Report.

criteria for a raw water supply and for Class I and Class II recreation are 2000/100 ml, 200/100 ml, and 2000/100 ml, respectively. Fecal coliform in the South Platte range from 15/100 ml to 2.4×10^5/100 ml, with a mean value of 15,321/100 ml.

Sulfate imparts an unpleasant taste to water and also has a laxative effect. Sulfate is not removed in conventional water treatment. The water criterion for sulfate is 250 mg/l. Sulfate concentrations in the South Platte range from 220 mg/l to 690 mg/l, with a mean value of 538 mg/l.

APPENDIX B

PUBLIC HEALTH

Literature Summary - Public Health

Different levels of pathogen removal by various treatment processes should be considered when using reclaimed water. Bryan (5) discussed the removal of a wide variety of bacteria and virus by processes in sewage treatment plants. Malina (6) analyzed more specifically virus removal by processes in both water and wastewater treatment plants.

Primary Sedimentation

Primary sedimentation normally removes less than 50 percent of the pathogenic bacteria from sewage (5). The wide variation in virus removals documented is probably due to variations in the concentrations of incoming suspended solids (6). Viruses are known to absorb to suspended solids and, hence, be much less detectable in an analysis of the liquid phase. This does not necessarily imply that their ability to infect is altered (7).

Biological Treatment

Biological treatment normally removes about 90 percent of the pathogenic bacteria (5). The different types of biological treatments vary somewhat in their ability to remove virus. Activated sludge and aerated lagoon systems are the two most effective. Both can remove more than 90 percent of the incoming virus. Careful operation can achieve removals of greater than 98 percent (6).

In another study by Malina (8), the sensitivity of virus removal to changes in different parameters of the activated sludge process was examined. Virus inactivation was found to be independent of (1) organic loading, (2) hydraulic detention times and mixed liquor suspended solids concentrations, and (3) whether oxygen or air was used in the process. Virus absorption to sludge was found to be almost immediate. It was determined also that inactivation in the process occurs in a time-stable sludge-virus complex. Further information concerning virus inactivation in activated sludge can be found in several other publications (9, 10, 11, 12).

Disinfection

Various disinfecting agents have received attention (10, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23), but chlorine remains the most widely used. Several factors influence the effectiveness of chlorine in inactivating pathogens. These are discussed in an article by Culp (23) and are: 1) pH and the concentration of hypochlorous acid present; 2) detention time; 3) turbidity or solids content (the lower the concentration of particulate matter including algal, the more effective is disinfection); 4) presence of oxides of iron, manganese and hydrogen sulfide; 5) presence or organic compounds; 6) temperature; and, 7) mixing.

Effective disinfection of wastewater with chlorine generally requires a solids free effluent, good mixing, adequate contact time and chlorination to the breakpoint to obtain a free chlorine residual.

The use of ozone as a disinfectant has recently been given increased consideration. In a comparison of ozone with chlorine (18), it was noted that ozone oxidizes phenols, cyanides and pesticides more completely than does chlorine. It also is unaffected by the presence of ammonium. Disadvantages of its use are lack of residual, cost and high sensitivity of bactericidal effectiveness to method of application.

Aerosol Transmission of Pathogens

One concern of spray irrigation systems is the health hazard posed by aerosols from the wastewater.

Sorber (24, 25) has shown in pilot plant studies that aerosols can disperse pathogens found in domestic sewage. A decrease in the number of inhaled infectious units occurred with a corresponding decrease in infectious viral units in the sewage. The viricidal effect of sunlight and higher temperatures was found to be definite, though the effect of relative humidity varied with different types of virus. In aerosols, the majority of bacteria die off in the first three seconds of exposure, while others persist longer.

A review of Stanford and others (9) analyzed the morbidity rate factors associated with spray irrigation of wastewater. The authors state that a literature search has not revealed any incidence of disease from irrigation with properly treated sewage (i.e., chlorinated secondary effluent). They also state that the formation of droplets smaller than 500 microns in diameter should be prevented.

Katzenelson (26) presented data on aerosol hazards due to spray irrigation with contaminated river water and aerated lagoon effluent. Coliform bacteria and Salmonella were found 350 meters and 60 meters (1,150 and 200 feet), respectively, from the sprinklers when contaminated river water was used. Only coliform bacteria were found in tests on aerosols from an aerated lagoon, and these were at a maximum distance of 30 meters (100 feet) from the sprinkler sites.

Irrigation with Wastewater Effluent

A committee organized by the Sanitary Engineering Division of the American Society of Civil Engineers stated that no outbreaks of disease due to crop irrigation with secondary effluent has been reported with the systems in use up to 1970 (27). However, a number of outbreaks have been associated with various types of foods contaminated with wastewater, some as a result of irrigation. One outbreak resulting from contaminated vegetables occurred with the use of secondary effluent. All other outbreaks were connected with water treated to a lesser extent (5).

Katzenelson (13) demonstrated the hazards of using partially treated non-disinfected oxidation pond effluent for irrigation. A survey of the incidence of singellosis, salmonellosis, typhoid fever and infectious hepatitis showed that these diseases were two to four times more prevalent in communities where spray irrigation was practiced than in others. Unconfirmed cases of influenza also occurred twice as often where spray irrigation with oxidation pond effluent was used. However, no significant difference in disease incidence was noted during the winter non-irrigation season.

One of the main hazards of irrigating crops with poorly treated sewage is the possible spread of infectious hepatitis. Neefe and Stokes (28) demonstrated that the causative agent of infectious hepatitis is transmitted in the feces of humans. In another article by the same author (29), the effects of the agent were shown to be much less severe after exposure of effluent to high concentrations of chlorine, but only partially diminished after treatment by aluminum sulfate or activated carbon.

Reuse of effluent for irrigation can be free of health hazards. The key requirement is proper disinfection which is defined as, "the art of killing the large portion of microorganisms...with the probability that all pathogenic bacteria are killed" (30). However, it must be understood that disinfection of ordinary wastewater does not kill all pathogenic organisms. Disinfection relative to public health protection is important in systems where effluent and reuse of the wastewater occurs in an uncontrolled environment and the potential for public contact is high. Where a high degree of control is provided, disinfection requirements can be less stringent.

APPENDIX C

EXISTING FACILITIES

FIRST AVENUE PLANT

Treatment Facilities

The First Avenue plant services the City of Greeley and has an average flow of 6.9 million gallons per day. Prior to 1973, it also treated wastewater from the Monfort plant until this industrial flow was diverted to the newly constructed Lone Tree Creek plant. Excluding infiltration and inflow contributions to the plant, the residential flow contribution accounts for 85 percent of the total flow. The other 15 percent is contributed from commercial and industrial sources; however, 25 percent of the BOD load comes from these two sources. The infiltration/inflow has been estimated at 1.3 million gallons per day, and up to four million gallons per day during heavy rainfall periods. The 85 percent residential and 15 percent commercial/industrial could be considered a representative flow condition for a city the size of Greeley.

As shown in Exhibit C-1, the First Avenue plant consists of an older South Side trickling filter plant and a newer (1964) North Side acti-vated vated sludge plant. The South Side facilities have a two million gallons per day nominal operation capacity, which is the flow presently being treated at the South Side facilities. The remaining flow, four to five million gallons per day, is treated by the North Side facilities, which have the capacity to treat an average flow of up to 6 million gallons per day.

The raw sewage is first directed to a recently constructed pretreatment unit for removal of large solid materials. The flow is then split by pumping a portion (two million gallons per day) to a primary clarifier on the South Side and the remainder to the North Side.

The South Side units, constructed in the years 1936 and 1955, consist of one primary clarifier, two trickling filters, one final clarifier, one chlorination basin, and a pumping and control building. The anaerobic digesters constructed in the years 1936, 1955 and 1964 are also located on the South Side.

The flow is pumped from the South Side primary clarifier to the trickling filters, where the waste is treated by trickling it through a medium consisting of rocks coated with microbial growth. The trickling filters are presently being operated so that the wastewater is 100 percent recycled through the trickling filters. The waste then flows by gravity to a final clarifier for settling of any solids that may have accumulated in the filters and subsequently sloughed off or passed through the filters. Following final clarification, the flow is mixed with the North Side flow for chlorination and discharge.

The North Side facilities consist of two primary clarifiers, two aeration basins, and two final clarifiers. The facilities are designed and

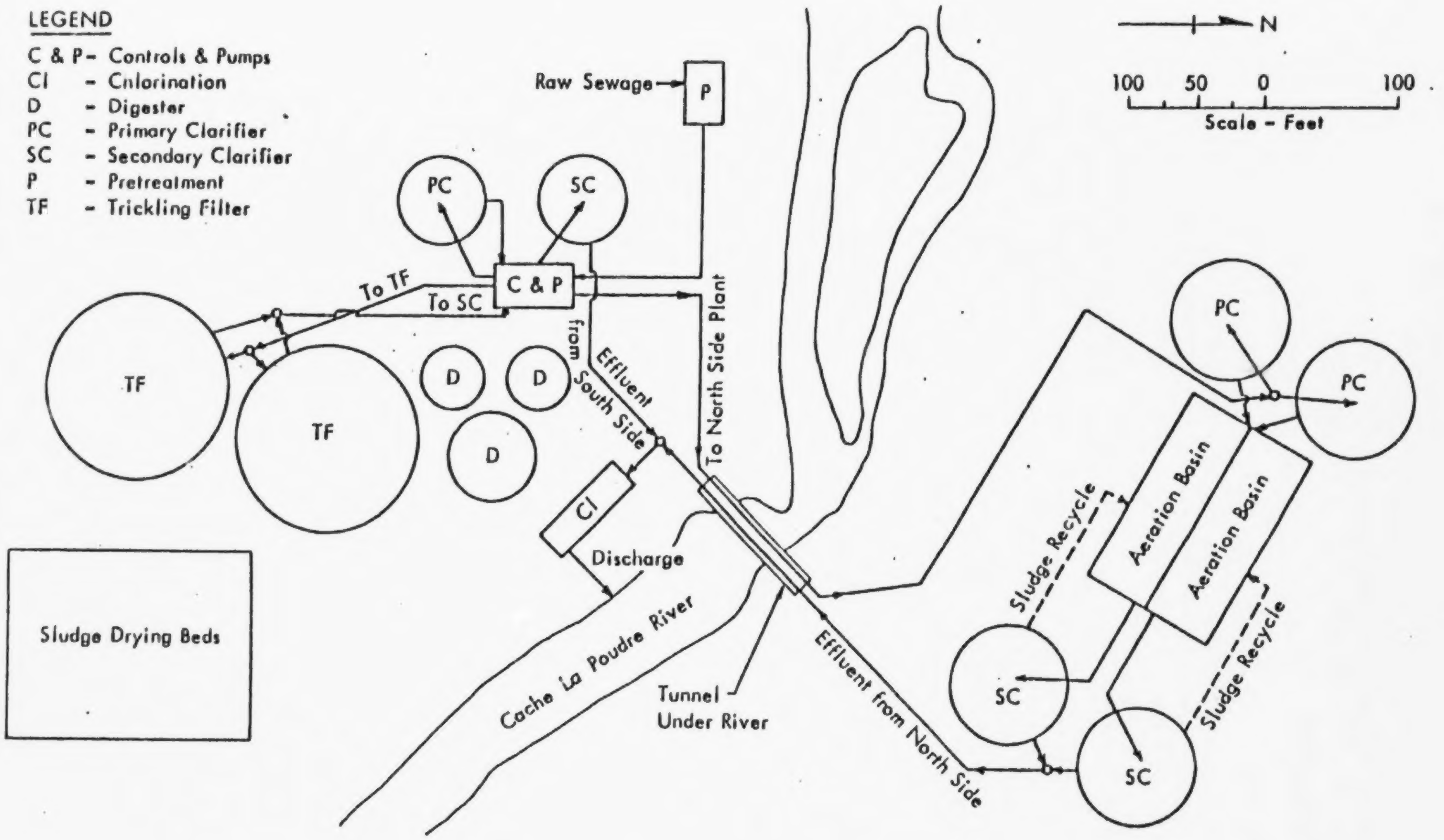

LEGEND
C & P - Controls & Pumps
Cl - Chlorination
D - Digester
PC - Primary Clarifier
SC - Secondary Clarifier
P - Pretreatment
TF - Trickling Filter
N
100 50 0 100
Scale - Feet
Raw Sewage
P
PC
SC
C & P
To TF
To SC
TF
TF
D
D
D
Effluent from South Side
To North Side Plant
Cl
Discharge
Sludge Drying Beds
Cache La Poudre River
Tunnel Under River
Effluent from North Side
PC
PC
Aeration Basin
Aeration Basin
Sludge Recycle
Sludge Recycle
SC
SC

EXHIBIT C-1 - First Avenue Plant Facilities operated as a conventional activated sludge system. The pretreated flow is pumped from the South Side through a tunnel constructed under the Cache la Poudre river to the two North Side primary clarifiers. The clarified waste flows by gravity through the remainder of the plant. The aeration basins contain a biological culture which is maintained for degradation of the remaining organic material in the waste. This culture forms a sludge and settles out in the final clarifiers. A portion is recycled back to the aeration basins to maintain the biological activity, and the remainder is pumped out to the Lone Tree Creek plant for treatment and disposal. The effluent from the final clarifiers flows back through the tunnel to the South Side where it is mixed with the South Side effluent prior to chlorination. The combined effluents are chlorinated and discharged to the Cache la Poudre.

The sludges produced at First Avenue are stabilized by anaerobic digestion. The 1964 digester is the primary digester and the other two are operated as a second stage in the three South Side digesters. The waste-activated sludge produced at the North Side plant is not digested at the South Side, but is pumped out to the Lone Tree Creek plant and disposed of in the anaerobic lagoons. The digested sludge can either be trucked to farmers directly from the digesters, or spread on the sand drying beds for dewatering and retention until there is sufficient agricultural demand for the sludge. At present, the demand for the sludge has been sufficient to dispose of all the sludge produced.

The annual average effluent concentration and highest monthly average concentrations of BOD and suspended solids (SS) are presented in Table . These data indicate that the plant performance improved markedly from 1972 to 1976 and have remained fairly consistent since 1976. The yearly average BOD and SS concentrations have been in compliance with the plants discharge requirements of 30 milligrams per litre for both BOD and SS (30/30). However, these standards are violated at times during the year. These violations are, in part, a consequence of operational upsets caused by slug discharges of industrial wastes.

Collection System

The Greeley sanitary sewer system consists of 207 miles of gravity sewers, eight miles of force main and nine lift stations. The Greeley system also receives some flow from sewers outside the corporate limits--Highland Hills, Farmers Truck Line Group and the Spanish Colony Sanitation District. The sewers are constructed primarily of vitrified clay and the remainder are concrete sewers. In 1974, the Poudre interceptor was constructed to relieve flows in the old North Trunk interceptor. The new 36-inch interceptor extends from the First Avenue Plant up into the Hilltop basin. There are some 12,200 service lines connected to the sanitary system amounting to over 180 miles of vitrified clay pipe.

Summary of Infiltration/Inflow Analysis

The following conclusions are presented in the infiltration/inflow analysis that was conducted on Greeley's sewer system:

- Infiltration/inflow averages 40 to 45 percent in the summer months and 18 to 21 percent in the winter months.
- Ninety-five percent of the infiltration originates in the service lines.
- Up to three million gallons per day of infiltration/inflow is removable through a sewer system rehabilitation program.
- It is more cost-effective to rehabilitate the sewer system, as opposed to constructing three million gallons per day additional capacity in a treatment facility.

INDUSTRIAL DISCHARGERS

The Monfort Meat Packing Plant is the largest industry within the City of Greeley, and removal of its effluent from the First Avenue Treatment Plant in 1973 to the Lone Tree Lagoons substantially improved the treatment performance of the First Avenue treatment plant. However, slug loadings from other industries into the First Avenue facility continue to cause reductions in treatment efficiencies. The City of Greeley contracted with CH_2M-Hill to conduct an industrial waste survey (1). The report identified six potentially significant industries whose wastes are being treated at First Avenue. These industries are:

- Meadow Gold Dairy
- Balcom Chemicals, Inc.
- Misco Textile Rentals, Inc.
- Cassedy Brothers Meat Co.
- HESCO Manufacturing, Inc.
- Sanitary Laundry and Cleaners, Inc.

Meadow Gold Dairy is identified as the largest single discharger into the sewer system. Meadow Gold's wastes comprise about 14 percent of the average BOD load to the treatment plant. This waste is high-strength, low volume, and is often discharged during early morning when dilution is minimal. This causes high-BOD shock loads on the plant which contribute to system upsets.

Balcom Chemicals and HESCO Manufacturing are identified as discharges of potentially toxic wastes. Balcom Chemical provides pretreatment of its wastes and discharges at a constant, low rate throughout the day to ensure adequate dilution. HESCO Manufacturing provides no pretreatment of its wastes and periodically discharges high-volume, high-strength waste. These discharges may account for some of the periodic strong, solvent odors reported by the First Avenue plant operators.

The two major dischargers of laundry wastes, Misco Textile Rentals and Sanitary Laundry and Cleaners, are relatively minor sources of BOD and suspended solids. No further pretreatment of these discharges is seen as necessary. It is expected that the First Avenue Plant can successfully treat these laundry wastes with no significant problems.

The industrial waste survey resulted in the following recommendations:

1. Require Meadow Gold Dairy to use its pretreatment facilities by enforcing the City ordinance which prohibits any discharge harmful to the treatment process.

2. Periodically analyze the Balcom Chemical discharge through an independent laboratory to ensure that discharge of pesticide materials remains below the detectable limits.

3. Require Balcom Chemicals to install a standby discharge pump which will ensure no discharge greater than two gpm from the drum washing facility.

4. Require HESCO Manufacturing to landfill all solvent and cutting oil wastes generated at their engine rebuilding plant. Enforcement action should be based on the same ordinance as applied to Meadow Gold Dairy.

5. As Cassedy Brothers Meat Company comes into full production, sample the discharge from the clarification equipment. Determine if the load from that source is sufficiently stable to allow treatment at the First Avenue Plant. Consider requiring prechlorination of the discharge to enhance grease removal and/or consider a separate lift station with discharge routed to the Delta Plant.

6. Install flow diversion structures to allow selective routing of the 24-inch South Trunk sewer, which serves Meadow Gold Dairy, Balcom Chemicals and HESCO Manufacturing, to the new high-stability treatment process at the Delta Plant.

7. As new industry enters the Greeley service area, investigate potential load variations as well as average loads expected. If substantial load variations are expected, locate new industrial dischargers in a place that allows routing of all highly variable wastes to the Delta Plant for treatment.

Implementation of these recommendations are essential in reducing periodic plant upsets of any biological treatment facility.

LONE TREE TREATMENT PLANT (EAST LAGOON)

This facility is located five miles east of Greeley and essentially serves the industrial waste from the Monfort Packing plant and provides some treatment for waste activated sludge from the North Side plant. The plant is a secondary biological type using the activated sludge process and is referred to as the lagoon plant because anaerobic ponds are utilized in place of primary clarifiers with large aerobic ponds providing effluent polishing. Discharge from this plant is to Lone Tree Creek and one mile above its confluence with the South Platte River.

The City of Greeley became obligated to treat Monfort Packing plant waste in accordance with an agreement dated March 7, 1970. Essentially, this contract stated that the city would build and operate the Lone Tree plant with a load capacity reserved for Monfort consisting of 4.3 million gallons per day and 30,000 pounds of BOD. Monfort is required to pay $51,600 annually as a capital contribution in addition to their share of all operating costs based on BOD load ratios. The contract further states that if additional capital costs are incurred to meet more stringent effluent standards, Monfort would be required to pay extra capital costs based on BOD loadings.

HILL 'N PARK SANITATION DISTRICT FACILITIES

The Hill 'n Park treatment system consists of two aerobic lagoons which may be operated in series or parallel at a retention time of 52 days. The lagoons are constructed with surface areas of 3.3 acres (at 10 foot depth) and 1.7 acres (at 5 foot depth). The facility services approximately 1,500 people and has an average daily inflow of 0.1 million gallons per day.

EVANS SANITATION DISTRICT FACILITIES

The Evans treatment facility consists of two aerated lagoons operated in series. This facility provides service for approximately 4,500 people in the Evans Sanitation District. The retention time of the waste in the lagoon is approximately 30 days and the average discharge from the facility is 0.6 million gallons per day. A third lagoon is planned for this facility, which would expand the potential treatment capacity to 1.2 million gallons per day.

The Evans Sanitation District sewer system constructed in 1962 consists of slightly less than 10 miles of vitrified clay gravity sewer. The majority of the sewers are eight-inch diameter pipe, the remainder being 10-inch and 12-inch. The 775 service line connections have a total length of 11.45 miles. There are no known storm sewer connections to the sanitary system and the infiltration into this system is estimated to be less than the allowable rate for a system of its size (0.02 million gallons per day); consequently, no sewer system rehabilitation is needed for this system.

The sewer system constructed in the 1965-1971 period consists of three miles of eight inch and ten inch gravity sewer made of vitrified clay pipe. The 150 service line connections account for 2.2 miles of pipe. There are no infiltration/inflow problems with this collection system.

APPENDIX D

The Use/Value Assessment

The use/value assessment is a tool that was originally created by Donald J. Epp, Associate Professor of Agricultural Economics at the Pennsylvania State University. It is a procedure designed to determine the productive value of agricultural land free from speculative influences. Originally, it was utilized as a tax assessment tool. It was adapted for this study by the URS Company.

The first step was to determine the net farm income for Colorado. This is found in Table D-1. Value of production for crops for Weld County was next determined to establish an approximate percentage share of sales which came out to 15.96%. The net farm income for the County was then found and subsequently divided by the percent of the total acreage for South Weld County. This was done because the Soil Conservation Service has not, to date, completed their survey for North Weld County. The income was then capitalized at 15% to obtain the total value of the agricultural land. Table D-1 presents these figures.

TABLE D-1

Net Farm Income (1977)	$163,300,000.00	
Percentage Share of Sales	15.96%	
County Net Farm Income	$ 26,062,680.00	
South Weld Survey Area Acreage	1,152,000.00	(44.6% of total County/acreage)
South Weld Net Farm Income	$ 11,623,995.28	
Capitalized Net Farm Income	$174,359,329.20	(at 15%)

The soils in the study area were placed into capability classes. Those that pertain to the study were grouped as follows:

Group A - Land Capability Class I. These are soils that have few limitations that restrict their use.
Group B - Land Capability Class II. These soils have "some limitations that reduce the choice of plants or require moderate conservation practices".
Group C - Land Capability Class III. These soils have "severe limitations that reduce the choice of plants or require special conservation practices, or both".
Group D - Land Capability classes IV and VI. These soils are restricted in their choice of plants, require careful management or are largely unsuited for cultivation. (Source: Soil Conservation Service, for a more detailed discussion of land capability classifications see: Land Capability Classification, Agriculture Handbook No. 210, SCS-USDA.)

Table D-2 shows the weights assigned to each soil grouping. The purpose of these weights is to reflect the relative contribution of the soil classification to the productive value of the agricultural land. The square root of the coefficient of variance was found for each grouping in relation to average yields per acre (for corn); the formula being $\sqrt{\frac{s}{x}}$. With Group D being unity (a weight of 1), all other groups were then substracted from Group D to arrive at the corresponding weight.

TABLE D-2

Soil Groupings and Assigned Relative Weights

Group	Weight
A	22
B	19
C	10
D	1

The use/value assessment formula was then applied to the data to determine the productive value per acre for each of the soil groupings. The formula reads $\sum_{i=1}^{N} (X_i)\ (Y_i)$

Where X = weights for soil groups and Y = acres of soils groups this figure is then divided into the capitalized net farm income to get the value per acre of Group D soils. This figure is then multiplied by each weighting to achieve value per acre for each soil group.

APPENDIX E

IMPACT OF TREATMENT FACILITIES ON LOCAL MARKET AND SURROUNDING LAND VALUES

Land values in a 25 mile radius surrounding Greeley have risen 12 to 15 percent over the last couple of years with most of this increase being a direct result of the soaring value of the related water rights. At present, irrigated land is valued between $1,500 to $2,000 an acre while range land is between $800 and $1,200*. Water rights in this area are in the range of $2,000 per acre foot.

The location of the treatment facilities in this farmland area is not likely to have a direct impact on land values. Mr. Thomas Reinbolt, an assessor with the Federal Land Bank in Greeley said that any significant land devaluation should not occur but that some slowdown in the rate of value appreciation might be expected in the short term. This same opinion was expressed by various realtors contacted in the Greeley area. Also, surrounding land values in the vicinity of the Muskegon County system (a similar treatment plant to the proposed Greeley system) have not been significantly impacted by the treatment program. Requests for building permits have risen almost 15% since the system began operation.

The new supply of corn produced in the study area could possibly be in competition with some of the corn for silage from the surrounding farms and would in turn effect the revenues that those farms are presently receiving. Indirectly, as the income generated from the crops decreases, the farmer may be faced with a similar decrease (or slow down in the rate of value appreciation) in the value of his land.

This, of course, assumes that the land application system is used only to grow corn. There are other alternatives, such as reed canarygrass, which may not be competitive with other silage crops and could provide superior water absorption.

Changing land values could also effect the Platte Valley School District (RE1) revenues. Their most prevalent concern though is in regards to the ownership status of the proposed treated land. If this land was to come under City ownership, then all associated land tax revenues to the district would be eliminated. At this time, however, there is every indication that the land in question will remain under private ownership, thus actually increasing tax revenues as range land is put into production.

Agricultural Economic Impact

The land application system is the only alternative that has a significant impact on agricultural economics. This is because the primary crop to be irrigated are revenue producing crops. Corn for silage is well suited to the project because of its nutrient removing capabilities and revenue potential, thus reducing operation and maintenance costs. Prices do fluctuate on a yearly basis, however. In 1978, corn for silage commanded about $3.90 per 100 lbs. for the Greeley market. This figure rose to between $4.65 - $5.00 per 100 lbs. for 1979.

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*Source: The Federal Land Bank, Greeley, Colorado

If the City tried to introduce an additional 2,000 - 3,000 harvested acres of corn on the local fall market, prices would most likely decrease significantly in the area. However, if the corn was stored and only introduced on the local market after the first year, fall prices of the local farmers would not be decreased. This is because after the first of the year, the feedlots demand cannot be met by the local farmers. Imported corn from Nebraska and Iowa is used to satisfy the demand. Prices in the winter are usually higher so the City would receive higher revenues by initially withholding their crop.

Alfalfa would not have as significant an impact on local market value as would corn. This crop is constantly being imported for silage into the area throughout the year. Prices have recently fluctuated between $45 - $70 a ton and the City entering this market would not significantly alter the fluctuation in this crop. Storage considerations would be eliminated, further reducing O & M costs. Reed canarygrass would possibly produce some revenue as silage. It is low in digestive nutrients and protein and would not command a high price in the market place. Presently, there is no significant market for reed canarygrass in the Greeley area.

A yield of 125 bushels per acre is considered a reasonable figure. The determining factor in reducing yields would be if the soils contained a particularly high salt content.

TABLE E-1

AVERAGE COLORADO CORN PRICES, GREELEY OR DENVER

	1975	1976	1977	1978	1979
January	$5.90	$4.85	$4.20	$3.80	$4.15
February	5.40	4.85	4.25	3.85	4.25
March	5.20	4.85	4.25	4.05	4.30
April	5.30	4.75	4.10	4.35	4.35
May	5.40	5.00	3.90	4.40	4.60
June	5.35	5.20	3.70	4.50	5.00
July	5.45	5.45	3.50	4.30	5.20
August	5.90	5.30	3.20	4.05	4.75
September	5.65	5.20	2.90	4.00	4.50
October	5.20	4.75	3.00	3.90	4.65
November	4.70	4.10	3.10	4.10	--
December	4.90	4.35	3.50	4.20	--

Source: Weld County Extension Service
Colorado State University

Source: Wastewater Facilities Planning
Report No. 1
Evaluation of Alternatives
For Greeley, Colorado
August, 1979
Volume II Appendices
By ARIX

APPENDIX F

WATER RIGHTS FULLY OR PARTIALLY OWNED BY GREELEY

The various waters owned by the City of Greeley are summarized in Table F-1. As this table reveals, there are different types of water owned by the City extending over almost all of the water-right types discussed above.

The direct-flow diversion rights on the Cache la Poudre River are represented by priorities 6 and 6-1/2 diverted at Greeley's raw water intake canal from the Cache la Poudre River above the Bellview Filter Plant at the river gage on the Poudre designated at the mouth of the canyon. These priorities have the amounts of 5 and 7.5 cfs, respectively.

Priority numbers 35, 46, 50, and 59 are decreed to the headgate of Greeley No. 3 Ditch for irrigation. The City of Greeley has two types of ownership in these water rights. The original ditch was constructed by Union Colony which was the owner of the four water rights stated above. At the time when the City of Greeley began to emerge as the center of the surrounding agricultural community, Union Colony deeded 3/8 of the water rights to the City of Greeley. With the remaining 5/8 of the water rights, Greeley Irrigation Company was formed with 525 original shares of water stock. From this time on, the ditch was run jointly by Greeley Irrigation Company and the City of Greeley.

At a later time, Greeley Irrigation Company acquired 60 preferred rights in Fossil Creek Reservoir with a corresponding storage volume of 1,377 acre-feet. This acquisition supplemented the water available under the four direct-flow diversion rights with 2.62 acre-feet of storage water per share.

The City of Greeley presently owns 21 shares of stock in the Greeley Irrigation Company which water stock was acquired by individual purchases. Speaking of terms of averages, this acquisition represents 20.8 acre-feet per share of direct-flow diversion and 2.62 acre-feet per share of reservoir water in addition to the 3/8 ownership of the original four water rights.

TABLE F-1

Waters Fully or Partially Owned by Greeley

	Priority	Amount (AF)	Subtotals (AF)	% of total
Direct-Flow Diversions and Plains Reservoirs				
Cache la Poudre River	6	3620		
	6-1/2	5430		
	35246250259	7280		
Reduction per W-7767		-390		
Fossil Cr. Res. 21 shares in GIC		55	15995	29.84
South Platte River delta irrigation			300	.56
Big Thompson River				
Greeley-Loveland		4708		
Seven Lakes Res.		650		
Lake Loveland Res.		430		
			5788	10.80
High Mountain Ditches (transbasin import)				
Columbine		100		
Bob Creek priority 85		300		
			400	.75
High Mountain Reservoirs				
Seaman		5008		
Hourglass		1711		
Comanche		2629		
Twin Lake		301		
Barnes Meadow		2349		
Peterson Lake		1239		
			13237	24.69
Colorado-Big Thompson project water			17888	33.37
Total presently owned -			53608	100.00

Other Minor Storage Water Rights

	Priority No.	Priority date	Amount (AF)
Gilmore Reservoir	112	1/22/1919	344
(needs excavation work, inactive)			
Porter Lake or North Poudre Res. #17	93	6/18/1906	601
(never filled above 18 ft.)	99	6/14/1908	322
Timberline Reservoir	42	8/13/1902	426
(dam broke in 1911 and has not been repaired)	55	6/01/1924	335
Trap Lake	131C	6/08/1922	328
(contitional upon completion of reservoir)	135C	6/01/1928	413
Total storage capacity of decree -			2769

Potential future water acquisitions and/or developments

Six-cities Windy Gap project water (transmountain import)	8000 AF
Greeley Irrigation Company, No. 3 Ditch	10900 AF
Fossil Creek Reservoir	1322 AF
Greeley-Loveland, Seven Lakes, Lake Loveland	?
Delta Irrigation	?
	20222+ AF

References:
1978 Annual Report, year ending Dec. 31, 1978, Water & Sewer Dept., Greeley, CO.
City of Greeley water in Canal No. 3, Resource Consultants, Inc., Apr. 1978.
Oral communication with Mr. Darryl Alleman, Director, Water & Sewer Dept., Greeley, CO.

Source: Arix Corporation

The City of Greeley owns and operates numerous groundwater wells within the city area for the irrigation of green areas in cemeteries and parks. In Water Court case number W-7767, the City obtained a decree to operate these wells as alternate points of diversion for some of the Greeley No. 3 Ditch water rights to the extent of 390 acre-feet per year of diversion. This water is therefore considered as not available from the general supply standpoint.

Through stock ownership, the City has water in Delta Irrigation Ditch, and in the Greeley-Loveland Irrigation Company, including Seven Lakes and Lake Loveland reservoir water. The present annexation policy of the City requires that developers provide water for lands they intend to annex to the City and Greeley-Loveland water is accepted for this obligation. It is therefore anticipated that the City's stock ownership in this company will increase with time.

The high mountain ditches represented by Columbine Ditch and Bob Creek diversion are both transporting water into the Cache la Poudre Basin from the Laramie River Basin and therefore can be considered as imported water. Unfortunately, these structures have not been used to their greatest potential in the past 10 to 20 years and their rejuvenation may run into difficulties with the Wyoming versus Colorado decision 353 U.S. 953, (1957). This case apportioned the water of the Laramie River between Colorado and Wyoming and thereby limited any future developments for transmountain diversions in Colorado.

The high mountain reservoirs owned and operated by the City of Greeley have active water rights and are being used intensively every year. These reservoirs represent a valuable asset to the City for these storage waters are available for direct diversion to the Bellvue Filter Plant for releases to the lower reaches of the river, or for an almost unlimited number of exchanges.

The Colorado-Big Thompson Project water owned by the City is a similarly important part of its water supply in which such water can directly reach the raw water treatment facilities of the City.

FUTURE WATER ACQUISITION AND DEVELOPMENT

The City's participation in the Six Cities Windy Gap Project will result in an increasing of the City's raw water supply by 8,000 acre-feet of imported water. In this project, water collected in the upper Colorado River Basin is transported to the Eastern Slope using the Colorado-Big Thompson Project facilities for the use by six communities, including Greeley. The construction of the project is presently underway and this water is anticipated to be available parallel to the construction of the new sewer-treatment facility of the City.

It is anticipated that at some future time, the expansion of the City will overtake the remaining irrigated areas under the No. 3 Canal. As development progresses, more and more of the corporate water stock should find its way to the City increasing its water supply ultimately to the average 18,000 acre-feet of diversion substantiated by the diversion records of the ditch. How soon this transaction will be completed cannot be estimated at the present time since it is a function of political and socio-economic developments.

Due to similar expansion, it can be anticipated that the City will increase its ownership of the Greeley-Loveland system. A similar acquisition is potentially possible on lands served by Delta Irrigation Canal and in the direction of the town of Evans. How much water will be transferred to the City from these sources and the timing of the transfer cannot be reliably estimated at the present time. For general planning purposes, a conservative estimate of the water-supply increase from these sources can be placed between 20,000 to 30,000 acre-feet per year.

Some minor storage rights are also owned by the City of Greeley and are listed in Table . With the exception of one, these water rights are considered inactive generally due to deficiencies of the impounding structures. Relative to the total water supply of the City, these water rights are minor ones; however, they may be used as trading stock with some of the larger irrigation companies.

ELEMENTS OF AN AUGMENTATION PLAN

Assuming that the City will have to augment for any additional consumption of its sewage effluent in the amount of the illegal depletions, the injured water rights, and the method and place of augmentation releases must be determined. Considering the sources of waters introduced into the City's system, depletions of in-basin diverted water and that of Colorado-Big Thompson Project water must be compensated for. As it was explained earlier, water imported by the City into the South Platte Basin can be completely consumed or the proportionate part of the effluent claimed for replacement purposes. At the present time, the City has only very limited ownership of such waters; however, after completion of the Windy Gap project, this type of water will become significant. The question as to whether replacement has to be provided for waters originating from the City's reservoirs cannot be specifically answered at this time. It was mentioned earlier that there are different legal theories concerning the reservoir water and if the City chooses to claim 100 percent of its reservoir waters, the question will probably have to be decided in court. To answer this question, the City will have to enlist the services of legal counsel with sufficient experience in water law.

After it is determined which of the City's water types require augmentation, the magnitude of the augmentation requirement at any day is relatively easy to determine from the filter plant's records. Since the City does not have substantial internal storage facilities that could change the timing of the return flow by an appreciable amount, an assumption of almost immediate effluent appears to be sufficiently correct. It is similarly reasonable to assume that within the City water-supply system, the different types of water undergo a complete mixing so that a proportioning based upon the sources is sufficiently accurate.

Determination of the injured water rights. If the river depletions resulting from the land-treatment of the sewage effluent are considered illegal depletions, there are two types of injuries to be considered. In the first one, the City is changing the point of effluent return to the stream and in the second there is a water consumption connected to the treatment process.

Treated sewage effluent released from the City into the Cache la Poudre is physically available to Ogilvy Ditch and to Hoover Ditch. Considering that the new point of return will be through Crow Creek, there are no other headgates between the old and the new points of return requiring this consideration.

Irrigators under the Hoover Ditch have decreed their shallow groundwater wells as alternate points of diversion to the direct-flow diversion right of the ditch. Apparently from an operational standpoint, there are practically no diversions from the river by that ditch and the water supply is obtained instead from groundwater. From this arrangement, it appears that the proposed change of the effluent point of the treated sewage will not injure these water rights.

Unfortunately, the same statement is not true for Ogilvy Ditch. The ditch has a certain physical reliance on the treated effluent that will have to be compensated for. The real question is the determination of the magnitude of the injury which question is somewhat complicated as explained in detail below.

A direct flow water right is entitled to place a call on the river for water when water is needed for beneficial use and the water is not available in the river at the headgate of the ditch. At the same time, the water right must be in priority; that is, there may be no call on the river by any more senior water right. The amount of water for which a call may be made is certainly limited by the amount of the water right itself.

On November 4, 1893, the City adopted Ordinance No. 70. Subject to numerous provisions in this ordinance, the City has granted the right to use part of its sewage effluent to a W. Albrecht Insinger. A 24-inch diameter conduit was to be constructed by said Insinger to transport the water from the City's collection point across the Cache la Poudre for use of the effluent on the north side of the river. The grade of said conduit was specified as 1 foot/1,000 feet. The estimated capacity of the conduit, assuming gravity flow, was somewhat above 8 cfs. The ordinance allowed Insinger to use the water for irrigation or to release the water to the Cache la Poudre River as he wished. Ordinance No. 70 grants the use of effluent waters to Insinger, his heirs and assigns. It is not known at the present time whether Ogilvy Ditch Company can be considered legally the assign of the original grantee.

Assuming that the grantee is Ogilvy Ditch Company, there is the question as to whether an agreement between two parties can override the administration of the priority system. Valid appearing arguments can be made for either side and this question has to be answered by legal counsel or possibly by the courts.

If the conduit required by Ordinance No. 70 is still in existence, a flow measurement in the conduit can be arranged to establish the upper limit of the amount that could have been the subject of the ordinance.

To estimate the amount of sewage effluent that could have been picked up by Ogilvy Ditch under the priority system, the historic ditch diversion, the historic City of Greeley sewage effluent releases, and the river-flow records in the Cache la Poudre River near Greeley have been collected and analyzed on a daily basis. The river-gaging station is about 1.8 river miles downstream below the headgate of Ogilvy Ditch. Therefore, on this short stretch of the river, only a limited amount of underground return flow or river gain can be expected. The amount of this river gain was assumed to be 7 cfs; that is quite high but would keep the results of the modeling on the conservative side.

It was considered that the "river" at the headgate of Ogilvy Ditch consists of the natural river flow and the total sewage effluent released by the City. To allow for the return flow between the ditch headgate and the gage, it was assumed that if the flow in the river at the gaging station is 7 cfs or less, Ogilvy Ditch has diverted the entire flow of the river at its headgate. Any river flow at the gate exceeding 7 cfs was considered to be available at the ditch headgate that the ditch has not diverted apparently in lack of need. This quantity then was deducted from the sewage effluent of the City and considered as releases not required by the Ogilvy water right. Subsequently, the daily sewage effluents that were diverted by Ogilvy Ditch were summarized to arrive at the seasonal totals. During the last five years, Ogilvy Ditch has obtained the following quantities from sewage returns: 1974 - 129 acre-feet; 1975 - 118 acre-feet; 1976 - 59 acre-feet; 1977 - 873 acre-feet, and 1978 - 6 acre-feet. These quantities have been made available to Ogilvy Ditch from the City of Greeley's sewage returns. The data show a quite variable water availability pattern, and at the time of designing and operating the final augmentation plan, a daily accounting will be required throughout the irrigation season.

Augmentation releases for Ogilvy Ditch can be made either through the Cache la Poudre River from sources above the headgate of the ditch or since the irrigated area of the ditch is between Lone Tree Creek and Crow Creek, treated water could be piped back from the treatment site directly into the ditch.

Injury to other water rights can be alleviated by releases through Crow Creek or at any point higher on the river. Similarly, any return-flow credit from the land-application treatment process will discharge into the river via Crow Creek.

Sources of augmentation water. The water rights belonging to No. 3 Canal cannot be physically used in the water-supply network of the City; therefore, they will be considered primarily for augmentation purposes.

The future growth of the City will undoubtedly result in the acquisition of additional agricultural water rights in the form of direct-flow diversion and storage rights. These will likely originate from areas around the City and most of them will not be suitable for treatment and direct use. Water obtained from the Windy Gap project presently under construction represents a significant quantity of valuable augmentation water. At the time the Windy Gap project is completed and the No. 3 Canal is fully acquired, only from these sources an estimated 8,000 to 10,000 acre-feet will become available for augmentation.

A part of the high mountain reservoirs that represent almost 25 percent of the present supply could immediately become available for augmentation. It is anticipated that this water will be used through exchanges in the augmentation plan rather than by direct releases to the river due to the high transportation losses. With the existing supply and the projected acquisitions, it appears that the City has ample water to meet its eventual augmentation requirements. The composition of the types of water rights is also fortunate and allows a large degree of operational flexibility in designing the augmentation plan.

APPENDIX G

WILDLIFE

Construction of the treatment facilities will cause a permanent loss of approximately 700 acres of wildlife habitat. The land application system will cause a loss of an additional 2,000 - 3,000 acres for the production of crops, although as an agricultural use, will itself provide a habitat between planting and cultivation.

Unknown numbers of small mammals will be lost during the construction stage of the project due to predation and construction related kills due to forced migration as burrows are covered and dug up. Nesting for Mourning Dove and songbirds potentially could be disturbed. This impact to wildlife would be minimal as areas for wildlife migration are numerous.

The construction of reservoirs would have a positive impact by creating a habitat for waterfowl. Most of the area under consideration for a reservoir is currently cropland so there would be minimal disturbance of wildlife habitat. Wildlife that might potentially benefit would be Canadian Geese, Mallards, the American Widgeon, various species of amphibians and reptiles, among others. Wildlife species that potentially occur in the study area are found below:

Class/Order/Common Name	Scientific Name
Mammalia	
Marsupialia	
Oppossum	Didelphis marsupialia
Insectivora	
Masked Shrew	Sorex cinereus
Vagrant Shrew	Sorex vagrans
Chiroptera	
Little Brown Bat	Moytis lucifugus
Long-eared Myotis	M. evotis
Small-footed Myotis	M. Leibii
Silver-haired Bat	Lasionycteris noctivagans
Big Brown Bat	Eptesicus Fuscus
Red Bat	Lasiurus borealis
Hoary Bat	L. cinereus
Townsend's Big-eared Bat	Plecotus townsendii
Lagomorpha	
Eastern Cottontail	Sylvilagus floridanus
Nuttall's Cottontail	S. nuttallii
Desert Cottontail	S. audubonii
White-tailed Jackrabbit	Lepus townsendii
Black-tailed Jackrabbit	L. californicus
Rodentia	
Richardson's Ground Squirrel	Spermophilus richardsonii
Thirteen-lined Ground Squirrel	S. tridecemlineatus
Black-tailed Prairie Dog	Cynomys ludovicianus
Northern Pocket Gopher	Thomomys talpoides
Plains Pocket Gopher	Geomys bursarius

Class/Order/Common Name	Scientific Name
Mammalia	
Rodentia	
Olive-backed Pocket Mouse	Perognathus fasciatus
Plains Pocket Mouse	P flavescens
Silky Pocket Mouse	P. flavus
Ord's Kangaroo Rat	Dipodomys ordii
Plains Harvest Mouse	Reithrodontomys montanus
Western Harvest Mouse	R. megalotis
Deer Mouse	Peromyscus maniculatus
Muskrat	Ondatra zibethicus
Meadow Vole	Microtus pennsylvannicus
Mexican Vole	M. mexicanus
Meadow Jumping Mouse	Zapus hudsonius
Porcupine	Erethizon dorsatum
Carnivora	
Coyote	Canis latrans
Grey Fox	Urocyon cineroargenteus
Red Fox	Vulpes vulpes
Raccoon	Procyon lotor
Long-tailed Weasel	Mustela frenata
Mink	M. vison
Black-footed Ferret	M. nigripes
Striped Skunk	Mephitis mephitis
Spotted Skunk	Spilogale putorius
Badger	Taxidea taxus
Artiodactyla	
Mule Deer	Odocoileus hemionus
Aves	
Anseriformes	
Canada Goose	Branta canadensis
Mallard	Anas platyrhynchos
Pintail	A. acuta
American Widgeon	A. americana
Shoveler	A. clypeata
Blue-winged Teal	A. discors
Connamon Teal	A. cyanoptera
Green-winged Teal	A. crecca
Lesser Scaup	Aythya affinis
Falconiformes	
Turkey Vulture	Cathartes aura
Rough-legged Hawk	Buteo lagopus
Ferruginous Hawk	Buteo regalis
Red-tailed Hawk	Buteo jamaicensis
Swainson's Hawk	Buteo swainsoni
Golden Eagle	Aguila chrysaetos
Bald Eagle	Haliaeetus leucocephalus
Prairie Falcon	Falco mexicanus
Peregrine Falcon	Falco peregrinus
American Kestrel	Falco sparverius

Class/Order/Common Name	Scientific Name
Aves	
Galliformes	
Bobwhite	*Colinus virginianus*
Prairie sharp-tailed Grouse	*Pediocetes phasianellus jamesi*
Ring-necked Pheasant	*Phasianus colchicus*
Columbiformes	
Rock Dove	*Columba livia*
Bank-tailed Pigeon	*Columba fasciata*
Morning Dove	*Zenaida macroura*
Strigiformes	
Great-horned Owl	*Bubo virginianus*
Short-eared Owl	*Asio flammeus*
Screech Owl	*Octus asio*
Barn Owl	*Tyto alba*
Passeriformes	
Horned Lark	*Eremophila alpestris*
Common Crow	*Corvus brachyrhynchos*
Magpie	*Pica pica*
Western Meadowlark	*Sturnella neglecta*
House Sparrow	*Passer domesticus*
American Robin	*Turdus migratorius*
Starling	*Sturnus vulgaris*
Red-winged Blackbird	*Agelaius phoeniceus*
Brewer's Blackbird	*Euphagus cyanocephalus*
Common Grackle	*Quiscalus quiscula*
Brown-headed Cowbird	*Molothrus ater*
Grasshopper Sparrow	*Ammodramus savannarum*
Savannah Sparrow	*Passerculus sandwichensis*
Lark Bunting	*Calamospiza melanocorys*
Vesper Sparrow	*Pooecetus gramineus*
Lark Sparrow	*Chondestes grammacus*
Chipping Sparrow	*Spizella passerina*
Song Sparrow	*Melospiza melodia*
Amphibia	
Caudata	
Tiger Salamander	*Ambystoma tigrinum*
Anura	
Leopard Frog	*Rana pipiens*
Bull Frog	*R. catesbeiana*
Chorus Frog	*Pseudacris triseriata*
Rocky Mountain Toad	*Bufo woodhousei*
Reptilia	
Squamata	
Six-lined Racerunner	*Cnemidophorus sexlineatus*
Lesser Earless Lizard	*Holbrookia maculata*
Eastern Fence Lizard	*Sceloporus undulatus*

Class/Order/Common Name	Scientific Name
Reptilia	
Squamata	
Common Garter Snake	*Thamnophis sirtalis*
Plains Garter Snake	*T. radix*
Western Terrestrial Garter Snake	*T. elegans*
Western Rattlesnake	*Crotalus viridis*
Racer	*Colubar constrictor*
Gopher Snake	*Pituophis melanoleucus*
Milk Snake	*Lampropeltis triangulun*
Smooth Green Snake	*Opheodrys vernalis*

Sources:
- Armstrong, 1972
- Bailey & Niedrach, 1965
- Robbins et al., 1966
- Smith, et al., 1965
- Stebbins, 1966